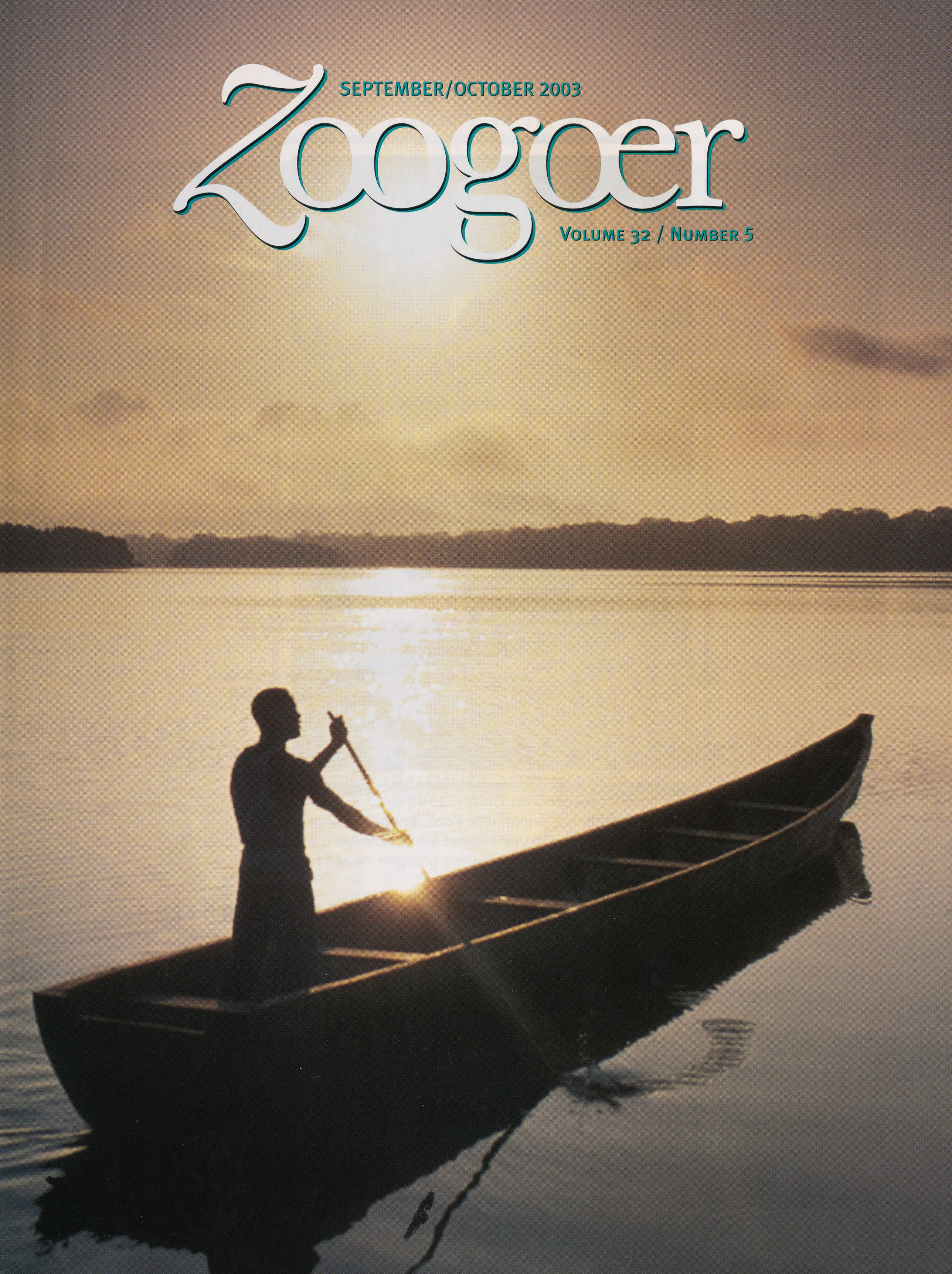
SEPTEMBER/OCTOBER 2003

Zoogoer

VOLUME 32 / NUMBER 5



© 2002 Fuji Photo Film U.S.A., Inc. © 2002 Windland Rice

Some images preserve more than memories.

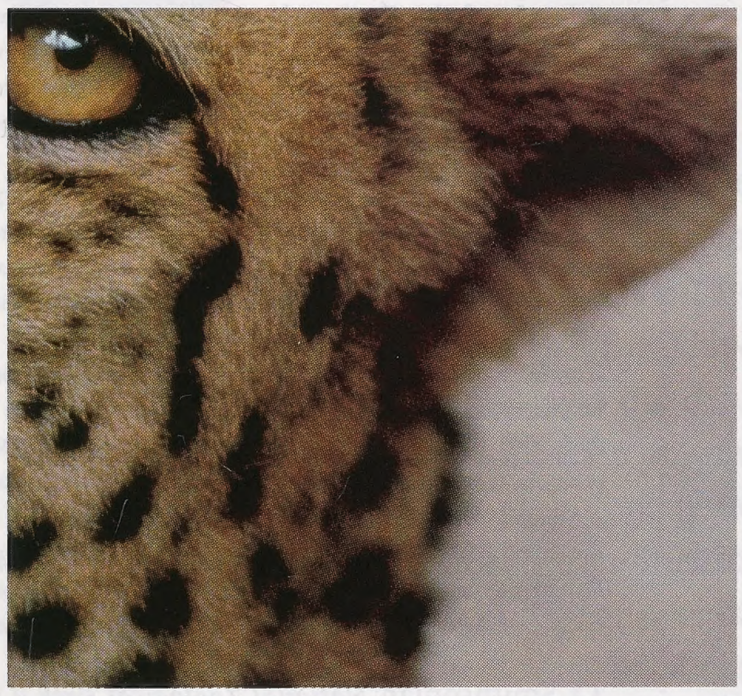
Partners in Conservation Education

In an effort to secure their future in China and North America, Fujifilm is proud to sponsor the future home of two giant pandas at the Smithsonian's National Zoo. Mei Xiang and Tian Tian will be housed in a state-of-the-art facility under the care of the National Zoo. Fujifilm recognizes that although photography is wonderful for preserving memories, it can never replace the real thing. www.fujifilm.com

Friends of the National Zoo

FUJIFILM

SEPTEMBER/OCTOBER 2003 VOLUME 32, NUMBER 5



8

10

18

8 A FOND FAREWELL

FONZ staff bid farewell to Executive Director Clinton A. Fields after 16 years of superb leadership and dedicated service to Friends of the National Zoo.

10 RIVER DOLPHINS OF NO RETURN

BY ROBIN MEADOWS

The freshwater dolphins of Asia and South America have an interesting natural history, surprising ancestors, and problems all their own.

18 TEEMING LIFE IN GABON'S RAINFOREST

BY FRANCISCO DALLMEIER, ALFONSO ALONSO, PATRICK CAMPBELL, AND MICHELLE LEE

The Smithsonian National Zoo's Monitoring and Assessment of Biodiversity Program reports on the biodiversity of Gabon's Gamba Complex, where it has an ongoing partnership with Shell Gabon.

DEPARTMENTS

6 NOTES & NEWS

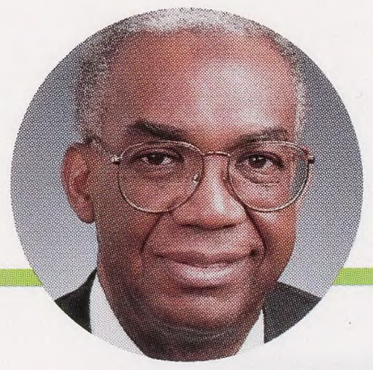
A look at fall fun and festivities, new animals make the scene at the Zoo, and Zoo scientists extend the genetic fitness of a deceased aardwolf.

30 BOOKS, NATURALLY

Butterflies imitate art and art imitates butterflies in *An Obsession with Butterflies* and *A Few Short Notes on Tropical Butterflies.*

31 BIOALMANAC

The Good News is that endangered kit foxes find shelter with farmers of Kern County, California; Bad News asks you to look beyond the brim of your coffee mug; and What's in a Name shows how the winners get the first crack at writing history, scientific and otherwise.



FONZ FORUM

A SALUTE TO FONZ MEMBERS

In my final *ZooGoer* letter as Executive Director, I want to thank you, the members of Friends of the National Zoo, for your generous and unwavering support throughout the 16 years of my tenure here. My mantra over all of this time has been that members are the life's blood of our organization and the cornerstone of our efforts to support the Smithsonian's National Zoo. In every way, you have proven this statement to be true.

Members are our most frequent visitors, coming to the Zoo an average of four times each year, plus attending many special events. During these visits, members account for much of our National Zoo Store sales. In addition, your virtual visits to our Zoo Store online represent a significant percent of our online sales. These visits, actual and virtual, tell us that you share our love and commitment to this very special place. And your purchases translate into a substantial part of the $500,000 that FONZ provides to the Zoo in the form of annual grants.

These grants support the work of Zoo scientists and provide stipends for Zoo interns who significantly contribute to Zoo operations in all areas. Among the projects that grants have supported for many years are the highly successful golden lion tamarin conservation program, the black-footed ferret conservation breeding program, and studies of the reproductive biology of many species, including studies of Asian elephants that led to the birth of Kandula in 2001. Students and interns supported by FONZ grants have gone on to become conservation leaders in zoos, conservation organizations, and universities throughout the United States and the world.

In our fee-based education programs—classes, seminars, camps, and eco-tourism activities—members comprise more than 95 percent of the participants. This reflects the desire of FONZ members to learn more about wildlife so they can contribute to its conservation, and they ensure that their children grow up enjoying the wonders of nature and understanding their place in the natural world.

Members also purchase more than 90 percent of the tickets to our growing number of fundraising events at the Zoo—National ZooFari, Guppy Gala, Boo at the Boo, Woo at the Zoo, and our burgeoning Young Professionals' socials. Proceeds from all of these events and activities support our public education programs, research efforts, and exhibit construction and improvement programs. FONZ members enjoy participating in our events—and appreciate the fact that their good time is for a good cause.

And, finally, members are the major source of solicited and unsolicited contributions to the Zoo. Your gifts—through our annual year-end appeal, ADOPT a Species program, matching-gift program, and membership dues—sustain the Zoo's animal care and acquisition efforts and our visitor-enhancement programs.

Throughout our community and nation there is a growing need and call for shared support from public and private sectors for our educational and cultural institutions. Your support of the National Zoo through FONZ serves as a highly successful model of what is possible, and how such programs should work.

I salute and thank you, the members of FONZ, for your loyalty and your commitment to the National Zoo. You have generously supported us in everyway through good and bad times and admirably lived up to your title of Friends of the National Zoo.

I am retiring from my job but not leaving the FONZ community of people who love the National Zoo. I hope to see you often when I visit the Zoo in the months and years ahead.

With admiration and affection,

Clinton A. Fields
Executive Director

Friends of the National Zoo is a non-profit organization dedicated to supporting the conservation, education, and research efforts of the Smithsonian's National Zoo. Formed in 1958, FONZ was one of the first conservation organizations in the nation's capital. Friends of the National Zoo is dedicated to supporting the Smithsonian's National Zoo in a joint mission to study, celebrate, and help protect the diversity of animals and their habitats.

ZooGoer [ISSN 0163-416X] is published bimonthly by Friends of the National Zoo (offices located at the Smithsonian's National Zoological Park, 3001 Connecticut Ave., N.W., Washington, DC 20008-2537) to promote its aims and programs, and to provide information about FONZ activities to its members, volunteers, and others interested in the purposes of FONZ. Periodicals postage paid at Washington, D.C. Postmaster: Send change of address to *ZooGoer*, 3001 Connecticut Ave. NW, Washington, DC 20008-2537. Copyright 2002. All rights reserved.

Smithsonian ***National Zoological Park*** is located at 3001 Connecticut Ave., N.W., Washington, DC 20008-2537. Weather permitting, the Zoo is open every day except December 25. Hours: From May 1 to September 15, grounds are open from 6 a.m. to 8 p.m.; buildings, 10 a.m. to 6 p.m. From September 16 to April 30, grounds are open from 6 a.m. to 6 p.m.; buildings, 10 a.m. to 4:30 p.m.

Membership in FONZ offers many benefits: publications, discounts on shopping, programs, and events, free parking, and invitations to special programs and activities to make zoogoing more enjoyable and educational. To join, write FONZ Membership, National Zoological Park, Washington, DC 20008, call 202.673.4961 or go to www.fonz.org.

Membership categories and annual tax-deductible dues are:

Family (includes children 3-16 years)	$49
Double	$44
Individual	$39
Senior Citizen (individual or couple)	$25
Contributing	$75
Sustaining	$150
Patron	$250
Sponsor	$500
Benefactor	$1000
Director's Circle	$2500
ZooGoer (for those outside a 200-mile radius of Washington, DC)	$25

($8 of membership dues goes to a *ZooGoer* subscription)

FONZ Board of Directors

Lloyd W. Howell, Jr., *President* Mark R. Handwerger, *First Vice President* Jeffrey Lande, *Second Vice President*, Grace Y. Toh, *Treasurer* Nicole M. Chestang, *Secretary*, Tom Arundel; Marcie Bane; Jeanne Beekhuis; Patricia A. Bradley; Christopher Capuano; Robert V. Davis; Sheila M. Ford; Michele V. Hagans; James F. Hinchman; Richard C. Hotvedt; Bernard K. Jarvis; Alberta "Missy" Kelly; Robyn S. Kravit; Gloria Kreisman; Mary C. Langlais; Harald R. Leuba; Suzanne Mink; Sue Ruff; Edward A. Sands; Eric D. Weiss. *Executive Director*: Clinton A. Fields.

ZooGoer

Publisher: Clinton A. Fields
Editor: Susan Lumpkin
Associate Editor: Brendan Horton
Intern: Stephanie Hsia
Contributing Editors: Robin Meadows, Howard Youth
Consulting Editor: Robert Hoage
Copy Editor: Jean B. McConville
Design: Lloyd Greenberg Design, LLC
Advertising Sales: Joyce Rains; 301.530.0583

Visit FONZ's website at: www.fonz.org

Cover photo: A local fisherman guides his dougout canoe at sunrise, Ndogo Lagoon, Gamba, Gabon. Photo by Carlton Ward, Jr.

Recycled paper

AZA Accredited — The Smithsonian's National Zoo is accredited by the American Zoo and Aquarium Association.

LETTER FROM THE ZOO DIRECTOR

CELEBRATE, STUDY, AND PROTECT

Our mission is the impetus for all the daily—and nightly—bustle and activity in the park. It is also the driving force behind our science, conservation, and education programs, some of which are very visible to our Zoo visitors, but many of which happen behind the scenes. You may wonder where "behind the scenes" is at the Smithsonian's National Zoo. The answer is: just about anywhere. Our scientists and educators work in laboratories and classrooms at the Zoo, at the Conservation and Research Center in Front Royal, at other zoos and conservation organizations around the world, and in the field.

It's easy to see how we celebrate our animals. On any day at the Zoo, you can find crowds watching our Asian elephant calf, Kandula, doing what young elephants do, or our newest flamingos, stretching their awkward legs in the mud. Mei Xiang and Tian Tian, the Zoo's giant pandas, welcomed their five millionth visitor in July, spending a full hour enjoying a frozen enrichment treat. Our playful, golden lion tamarins have discovered that they are truly free to move in and out of Beaver Valley, to the visible (and audible!) delight of zoogoers.

Zoo scientists began nearly 30 years ago to create an international partnership to save the golden lion tamarin, native to Brazil's eastern coastal forests. At that time, there were just 200 golden lion tamarins remaining in the wild, living in an area representing just two percent of their original range. Deforestation and rapidly expanding human populations had replaced most of their natural habitat, and the remaining forest was fragmented. This is a familiar story everywhere in the world, where smaller fragments of habitat remain for fewer numbers of plants and animals. With the help and expertise of National Zoo scientists, a protected area of Brazilian coastal forest was established, and this region now supports a healthy and stable group of reintroduced tamarins and their offspring.

This collaborative research also improved the ways in which zoos bred and fed the tamarins. In fact, the National Zoo became the principal breeder of this species, and the leader in their reintroduction to the wild. Today, as a result of decades of collaboration between the National Zoo's Golden Lion Tamarin Conservation Program, a consortium of zoos, conservation organizations, and Brazilian government agencies, there are about 1,200 tamarins in the wild and more than 450 in zoos worldwide.

This issue of *ZooGoer* provides a wonderful and inspiring sense of where some of our other "study and protect" efforts are happening, using the work of the National Zoo's Monitoring and Biodiversity (MAB) Program in Gabon, Africa, as just one example. It is extremely important to me—and to all of the National Zoo's staff—that our visitors understand this part of our mission. The scientific study of animals and their habitats teaches us all how we can protect our wildlife treasures. This work also ensures that we will have animal and plant species to celebrate in our zoos and in their native habitats.

Under the leadership of National Zoo senior scientist Francisco Dallmeier, the MAB program has developed a broad range of activities in tropical and temperate forests around the world, including Latin America and the Caribbean, North America, Asia, and Africa. MAB staff conduct scientific research and professional-training programs in and around these forested areas to help countries create their own facilities to foster the sustainable use of natural resources. Often referred to as the "storytellers of biodiversity," MAB scientists explore, teach conservation biology, and find useful ways to identify, manage, and conserve the species and habitats of the areas in which they work.

The research discussed in this issue takes place in West Central Africa—the Gamba Complex in Gabon. Scientists from MAB have not only discovered tremendous biodiversity in this part of the world, but they have worked to share these findings with industry representatives, government officials, and area residents and their schoolchildren, with the goal of advancing conservation in this region.

On another subject, I would like to extend my heartfelt thanks to outgoing FONZ Executive Director Clint Fields, as he leaves his FONZ leadership position to spend more time with his family. The good news is that Clint will continue to be a member of our National Zoo family. He has agreed to stay on as one of our key advisors as a member of the Zoo's Advisory Board. We have been joking with him that he is not actually retiring at all. Indeed, we are fortunate to have Clint's tireless support, creative ideas, and good nature as we continue to renew our National Zoo.

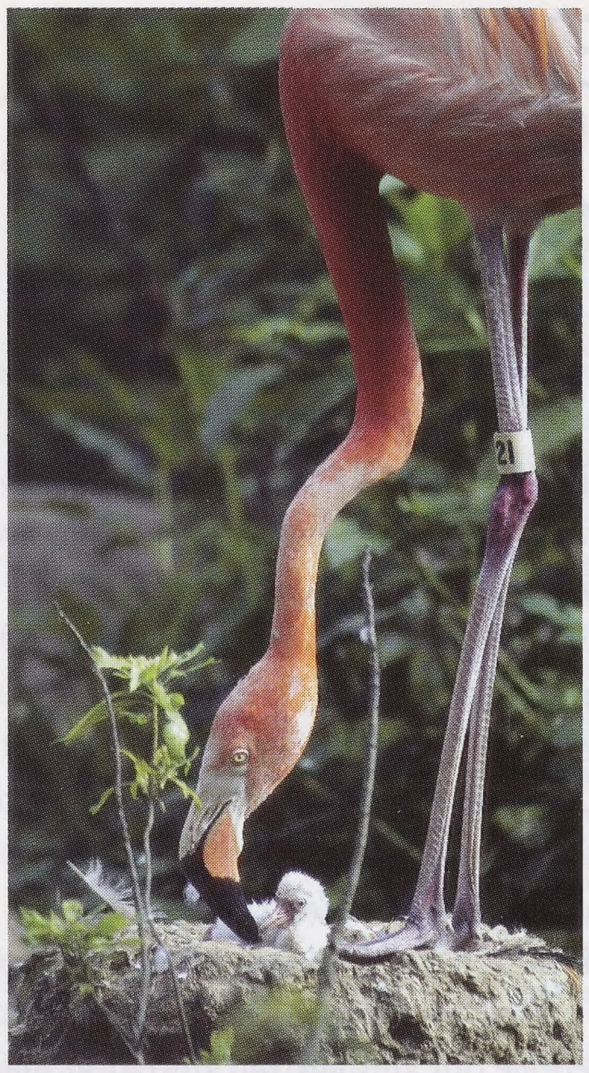
Lucy H. Spelman
Director
Smithsonian's National Zoological Park

NOTES & NEWS

>>ANIMAL NEWS

Three capybara brothers should reside in the National Zoo's Elephant House by the time this issue reaches your mailbox. Looking like a cross between a guinea pig and a hippopotamus, these South American animals are the largest of the 2,000 or so living species of rodents. Reaching greater than 100 pounds, an overall length of four feet, and a shoulder height of 21 inches, they live in large groups in the northern two-thirds of the continent east of the Andes. They live along riverbanks and among swamps and marshes, grazing on lush grasses and aquatic vegetation. Favoring water, as the scientific name suggests, *Hydrochaeris hydrochaeris* often retreat to the water when threatened by predators, such as anacondas, caiman, harpy eagles, jaguars, pumas, ocelots, and people.

>>It's not often a road-kill animal gets the opportunity to increase the genetic fitness of its species, but that's what happened to an aardwolf (*Proteles cristatis*) found by Adrienne Crosier, a National Zoo post-doctoral fellow working in Africa. Crosier rescued the gametes from the young aardwolf by removing the testes one and a half hours after its deadly encounter with a car. She got a very concentrated sperm sample, which was frozen and stored at the Genome Resource Bank of the Cheetah Conservation Fund (CCF) in Namibia.



JESSIE COHEN / NZP

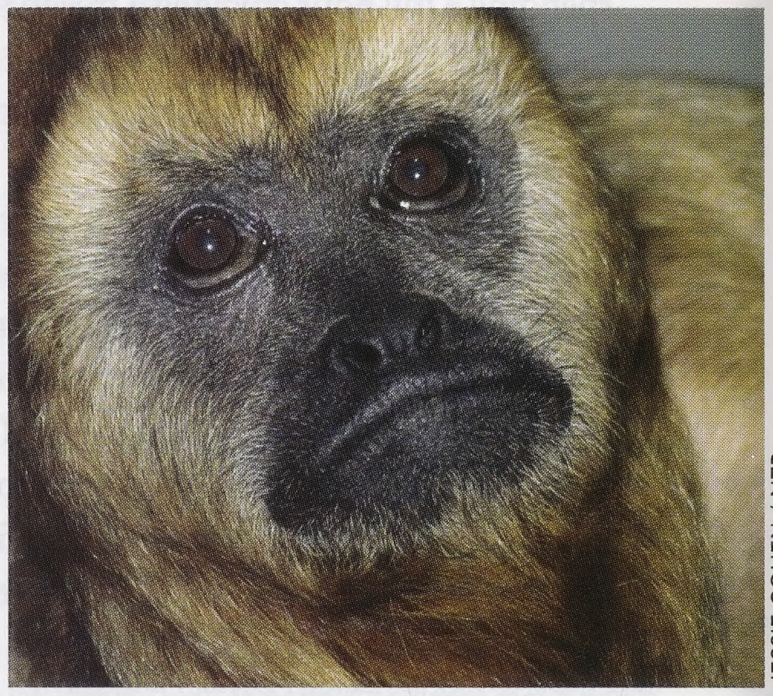
FLAMINGO CHICK HATCHED AT THE NATIONAL ZOO'S WETLANDS EXHIBIT.

These aardwolves are nocturnal mammals found throughout most of northeastern and southwestern Africa. They are insectivores, eating mainly termites and ants, and are strong diggers that reside in underground burrows. Although they resemble a dog or wolf, aardwolves are actually members of the hyena family. Their carnivorous appearance, however, makes aardwolves the target of humans, who often mistakenly suspect them of preying on livestock.

At the CCF, gamete samples are collected to obtain valuable genetic material from both endangered and nonthreatened species, including cheetah, lion, leopard, and aardwolf. Currently, the CCF bank holds primarily sperm, but other genetic materials are also collected. The gamete rescue on the aardwolf was made possible by putting the body in a refrigerator—viable sperm samples can be extracted 12 hours following death if the testes are kept cool. Sperm was then collected by flushing with a needle and syringe and mincing the epididymides, allowing the sperm to "swim-out" into a collection medium. The CCF genome bank stores frozen biological material such as sperm and eggs, skin, blood, and other tissues. There are no immediate plans to use this aardwolf sample and, for now, will remain a safety deposit for the future of the aardwolf.

THYS VAN DER MERWE / AFRICAN IMPRESSIONS

AARDWOLF CUBS.



JESSIE COHEN / NZP

BLACK HOWLER MONKEYS (*ALOUATTA CARAYA*) ARE WHOOPING IT UP AT THE ZOO

>>BE A FONZ MONTH

Join FONZ or renew your membership in September and get a free Giant Panda Video Album CD! Sponsored by Fujifilm, the CD shows videos from the daily lives of our beloved giant pandas, Tian Tian and Mei Xiang. You'll also continue to receive the privileges of FONZ membership: free parking while visiting the Zoo, discounts and advance notice for events such as Guppy Gala, ZooFari, and Boo at the Zoo, and exclusive opportunities to register for classes, camp, birthday parties, and Snore & Roar overnights at the Zoo. Upgrade now (even if your membership isn't expiring) and start receiving the higher membership benefits immediately. You'll enjoy the higher-level benefits for a full 12 months plus the remainder of your current membership year. Go to http://www.fonz.org for details.

>>ANNUAL MEETING

The FONZ annual meeting will be held at the newly renovated Mane Restaurant, October 17 from 6:30 to 8 p.m., and will include a reception from 6:30 to 7 p.m. In addition, there will be a hard-hat tour of the Kids' Farm exhibit currently under construction. The night's activities include remarks by Zoo Director Lucy Spelman and FONZ Board President Lloyd Howell, Jr., and we will welcome Board members and officers. It may also be a chance to meet and greet the new FONZ Executive Director, if someone has been found to succeed the retiring Clinton Fields at that time. We hope to see you there.

>>THE SHREW-D YP

At the last of this year's YP After-Hours events, on Thursday, September 18, from 6 to 9 p.m., FONZ Young Professionals can enjoy the big-band-themed "I Get a Kick Out of Shrew." Like all YP After-Hours events, this happy-hour soiree will feature music, free snacks, and a cash bar. A local big band will provide the music, and guests will have a swinging time as they participate in a fox-trot lesson. Guests will also have the opportunity to meet an animal keeper from the Small Mammal House and learn about some of the Zoo's most diminutive denizens. Tickets at the door are $8 for FONZ YP members and $10 for nonmembers (there is a discount on tickets ordered by 2 p.m. the day of the event). For tickets or more information, please call 202.673.4637 or log onto: www.nationalzoo.si.edu/ActivitiesAndEvents/YoungProfessionals/AfterHours/.

JESSIE COHEN / NZP

>>FIESTA MUSICAL

On Sunday, September 21, FONZ and the National Zoo will celebrate the Smithsonian Institution's Hispanic Heritage Month when they host Fiesta Musical 2003. Fiesta Musical is a celebration of Latin American culture and features a variety of family-oriented activities, including regional dance performances, traditional handcrafts, face painting, and a Latin American food court. Guests will also be treated to animal demonstrations, bilingual games and activities, and popular Latin and folkloric music. Admission is free; for more information, visit http://nationalzoo.si.edu/ActivitiesAndEvents/Celebrations/.

>>A FRIGHTFULLY GOOD TIME

The true ghosts, goblins, and witches in children emerge as they cavort through the Zoo during our annual Halloween weekend event Boo at the Zoo: October 24, 25, and 26 from 5:30 to 8:30 p.m. Kids get the chance to enjoy this fall tradition by trick-or-treating in animal houses, collecting candy from costumed volunteers, and creeping along haunted trails, in a safe and fun outing for kids of all ages. This is one of FONZ's most popular events, and tickets regularly sell out weeks in advance. Tickets are $10 for FONZ members, $20 for nonmembers, and free for kids under two. To assist guests arriving by Metro, FONZ will provide a free shuttle from the Woodley Park–Zoo/Adams Morgan station. (Children under 12 must be accompanied by an adult.) For more information, please log onto: http://nationalzoo.si.edu/ActivitiesAndEvents/Celebrations/.

Children's Film Program

SATURDAY, SEPTEMBER 20
FRIDAY, NOVEMBER 28
SATURDAY, NOVEMBER 29
East Building Auditorium
10:30 and 11:30 am
Ages 5 and up

In celebration of the exhibition *The Art of Romare Bearden*, this program presents two animated films about jazz: *Jazztime* (Michael Sporn, 25 mins.) and *Duke Ellington* (Ray Messecar, 15 mins.). Set in Harlem in 1919, *Jazztime* tells the story of two girls—one black, one white—who form a lifelong friendship through a chance encounter and the jazztime music of young "Fats" Waller. *Duke Ellington* is a tribute to the District of Columbia native, one of the greatest jazz artists of all time.

Film still from *Duke Ellington*

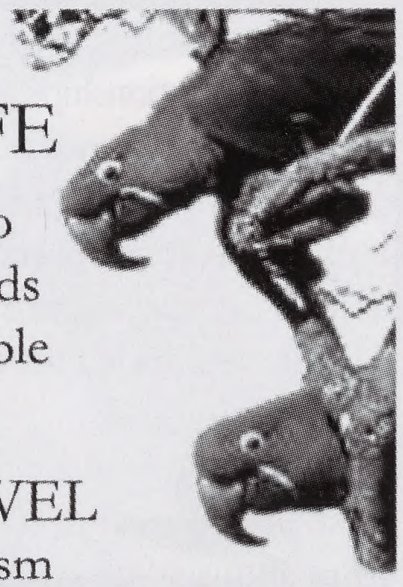
Free admission. No registration required. For details, call 202-789-4995.

Check out ***www.nga.gov/kids***, the Gallery's Web site for kids.

The Children's Film Program is made possible by the generous support of *washingtonpost.com*

National Gallery of Art
On the National Mall at Fourth Street and Constitution Avenue, NW
Admission is always free. Monday–Saturday, 10–5, Sunday, 11–6
General Information: 202-737-4215 TDD: 202-842-6176 *www.nga.gov*

SPECTACULAR AMAZON WILDLIFE



Guided natural history tours to Peru, Ecuador, Galapagos Islands and Brazil -- Visit our comfortable conservation lodges

TROPICAL NATURE TRAVEL
conservation through ecotourism
1-877-827-8350 or 1-877-888-1770
www.tropicalnaturetravel.com

Custom Safaris

Private luxury safaris as they used to be

800-247-7651

customsafaris@aol.com

CLINTON A. FIELDS:

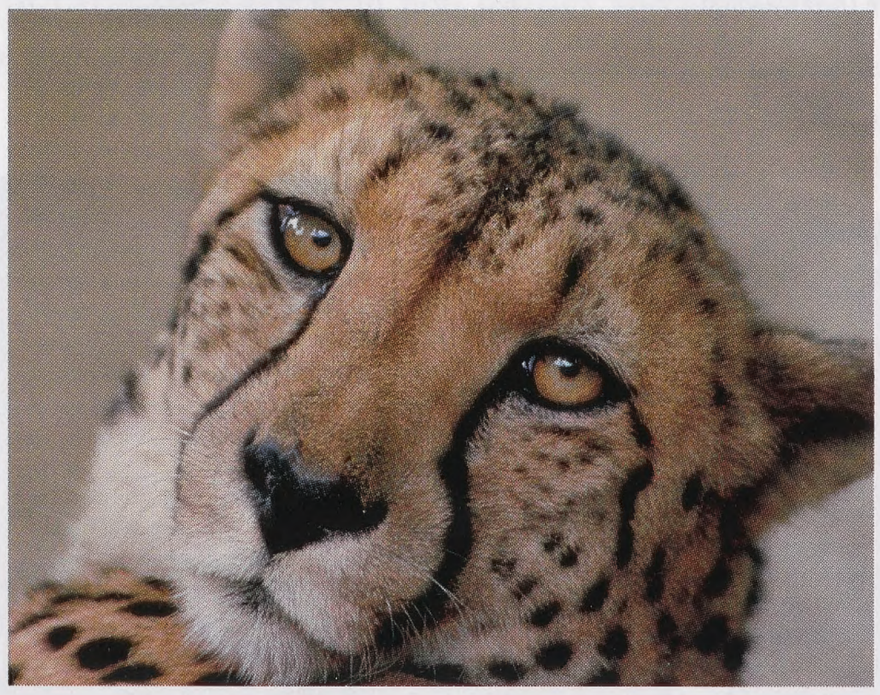
A FOND FAREWELL FROM HIS STAFF

Clinton A. Fields is resigning as Executive Director of Friends of the National Zoo. But his presence will long be felt at FONZ as he has left an indelible mark on our organization, and on the Smithsonian's National Zoo, in his 16 years at the helm. From his first day on the job to his last, Clint led FONZ with unflagging enthusiasm, passion, energy, and determination. No day went by that Clint didn't have a new idea, solve a problem, make a change, or teach his staff a new lesson that improved FONZ as an organization devoted to supporting the Zoo and playing a positive role in our community.

Clint's accomplishments since he arrived to lead FONZ in 1987 are legion, and in this short space we can list only some of the most significant ones. Clint served under nine different presidents and many other members of the FONZ Board of Directors, with whom he forged strong, synergistic relationships. Clint wholeheartedly carried out all of the Board's goals and, in turn, the Board members lent their trust and support to Clint as he directed the FONZ organization to achieve those goals.

FONZ grew dramatically under Clint's visionary leadership. FONZ membership grew from about 50,000 individuals to more than 90,000, and FONZ's volunteer corps expanded from 600 people to more than 1,800. He created new programs for members, including the wildly popular Snore & Roars, FONZ's accredited summer nature camp at the Zoo's Conservation and Research Center, and Zoo birthday parties for children. He launched three new member categories: CRC, Young Professionals, and Corporate, and created new involvement opportunities such as ADOPT a Species and the Wildlife Walls program.

FONZ's annual gross revenue from its management of the concessions at the Zoo doubled from about $6 million to $12 million; the net proceeds of these revenues support a wide array of Zoo programs. During his tenure, FONZ opened its first National Zoo Bookstore, launched off-site Zoo Stores and the online Zoo Store, built new Zoo Stores at Panda Plaza and Lemur Island, and a new food-service facility at Panda Plaza, constructed the Picnic Pavilion, and renovated the Mane Restaurant.



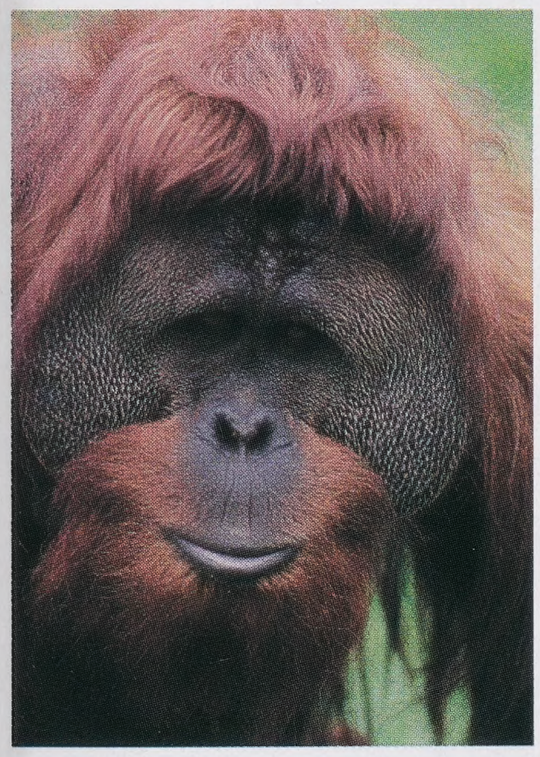
Clint led FONZ's development efforts on behalf of the National Zoo. He was instrumental in developing the funds needed to bring giant pandas Mei Xiang and Tian Tian to the Zoo in 2000, through a capital campaign that raised $22 million. He initiated such popular and successful fundraisers as the annual Guppy Gala for kids and FONZ's Halloween party, Boo at the Zoo. He turned FONZ's annual spring gala, National ZooFari, into one of the most popular events in the Washington, D.C., area by enlisting the support of the entire community, from restaurateurs and entertainers to business leaders and the media. As a result, ZooFari net proceeds increased from $30,000 in 1988 to $350,000 in 2003.

He championed annual special events and festivals to attract diverse audiences to the Zoo, including summer's Sunset Serenades, Easter Monday's African–American Family Day, and the Hispanic Heritage Month celebration, Fiesta Musical. He initiated or expanded educational events such as Focus on Science and North American Wildlife Celebration (formerly Seal Days). He involved the corporate community in the Zoo by creating a program for the Zoo to serve as a venue for corporate events. And he reached out to seniors and sick children unable to visit the Zoo by taking the Zoo to them, through the Zoo on Wheels program.

Clint is committed to education and he assumed responsibility for leading school and public-education programs at the Zoo, overseeing a remarkable expansion of those programs to reach visitors, students, and teachers in the Zoo and through the FONZ/National Zoo website. The educational role-playing exhibit for young children—How Do You Zoo?— was built

PHOTOGRAPHS BY JESSIE COHEN

during his tenure, and educational volunteer programs for teens were created. Clint also ensured that the young people who work at the Zoo during the busy summer season, many entering the work force for the first time, learned from their experience, so they gained job training as well as an introduction to the world of wildlife. He taught all of us how to be better managers and professionals, and attempted to instill in us, by lesson and example, the virtues that make leaders.



It is safe to say that no area of the Zoo remains untouched by FONZ's support, thanks to Clint's commitment to the Zoo and his belief in its important mission. From the bronze lions that now grace the Zoo's Connecticut Avenue entrance to the Fujifilm Giant Panda Conservation Habitat and the golden lion tamarins that range freely along the Valley Trail, FONZ, under Clint's leadership, has contributed to improving the Zoo and its ability to inspire concern for the conservation of wildlife and wild lands.

These are some of Clint's tangible, visible-to-all achievements. But these achievements were possible because Clint is, first and foremost, a leader of men and women. Clint never lost sight of the mission or of the importance of the people who work to achieve it. His integrity, loyalty, decisiveness, selflessness, and moral courage made all of us on the FONZ staff good followers. When, metaphorically speaking, Clint said "Take that hill," we charged—but only, of course, after pooling our diverse skills, listening to everyone's ideas, making a careful plan, reconnoitering the battlefield, adjusting the plan, and, most important, being ready to solve the unexpected—and the hill, once charged, one way or another, got took.

Clint developed his talent for leadership during a distinguished career in the U.S. Army, from which he retired as a colonel in 1987 just before coming to FONZ. As a result, military metaphors and models pervade our organization. Even those of us who come from decidedly more free-spirited backgrounds quickly embraced these metaphors and models, while Clint took our ribbing about references to "meeting at 14 hundred hours in Charlie Lot" (rather than at 2 p.m. in Parking Lot C) with his typical good humor—another sign of a great leader. Clint's propensity for the judicious use of very creative profanity doubtless springs from his military years as well—and was highly effective in capturing our flagging attention.

Clint's moral integrity and beliefs, however, have deeper roots, in his southern Christian upbringing. Clint is an honorable man, with an unwavering commitment to doing the right thing. Clint believes in doing unto others as you would have done to you, and acts accordingly. He believes in the importance of family, and the responsibility that hospitality entails. He is intolerant only of intolerance. He cares about people and is interested in their welfare. And he has the essential qualities of humility, understanding that everyone fails once in a while, although none of us can remember Clint doing so.

All of these things have made FONZ under Clint's leadership a great place to work. That six of FONZ's nine staff directors have been with FONZ since Clint's arrival, and another since 1989, is a testament to the high quality of the workplace that Clint created.

In another lesson from the military (we call them Clint's "Parables from the Pentagon"), Clint has described an exercise in which leaders are sequestered in headquarters while their troops are mobilized to conduct a war game. The leaders are graded on how well their troops do without them. We hope we earn high marks for Clint in the years ahead. The best gift we can give Clint for his years as our boss is to say, "We can do it well and right without you."

Kathi Berge, Comptroller; Fran Bernstein, Director of Membership, Marketing, and Development; Merva Crawford, Director of Merchandising; Susan Lumpkin, Director of Communications; Kurt Meyer, Director of Food Service; Pat Petrella, Director of Education and Volunteer Services; Raff Seymour, Director of Guest Services and Operations; Laurie Stroman, Director of Human Resources; and Jim Schroeder, Deputy Executive Director.

RIVER DOLPHINS OF NO RETURN

BY ROBIN MEADOWS

RIGHT: THE TAUNSA BARRAGE IN PUNJAB, INDIA IS USED TO HOLD BACK AND DIVERT WATER FOR IRRIGATION.

LEFT: AMAZON RIVER DOLPHINS SWIM TOGETHER IN A SOUTH AMERICA WATERCOURSE. THE INTERNATIONAL SOCIETY FOR THE PRESERVATION OF THE TROPICAL RAINFORESTS HAS CREATED A PROGRAM CALLED THE PRESERVATION OF THE AMAZONIAN RIVER DOLPHINS, WHICH, AMONG OTHER THINGS, PROVIDES ECOTOURISM OPPORTUNITIES FOR THOSE WHO WANT TO WITNESS RIVER DOLPHINS FIRSTHAND (VISIT THEM AT HTTP://WWW.ISPTR-PARD.ORG/CONTACT.HTML).

RIGHT: LOCALS ON THE BANKS OF THE INDUS RIVER AWAIT THE RETURN OF FISHERMEN.

© GILL BRAULIK

©ANDREA FLORENCE / ARDEA LONDON

QUICK—

let's test your dolphin knowledge by playing "two truths and a lie." Which of the following three statements is not true?

- Dolphins are related to hippopotamuses.
- Dolphins swim in rainforests.
- Dolphins sing long, complicated songs.

If you guessed that the last statement is wrong, you're right. Whales sing—dolphins make clicks and whistles. As for how hippos and dolphins are related, see the sidebar "The Dolphin–Hippo Connection" on page 15.

Surprised that dolphins swim in rainforests? I was too. But it's true: Dolphins live in the Amazon River and, when it floods the surrounding forest, they swim among the submerged tree trunks, hunting fish that eat the fruit and seeds on the inundated forest floor.

Worldwide, there are four types of dolphins that live only in rivers. The Amazon River dolphin (*Inia geoffrensis*) is the only one that is still plentiful. The other three live in Asian river systems and all of them are endangered: The Yangtze River dolphin (*Lipotes vexillifer*) is almost extinct, and the Indus and Ganges river dolphins (*Platanista minor* and *P. gangetica*, respectively) are down to about a thousand and a few thousand, respectively.

While there is still time to save the Indus and Ganges river dolphins, they face many of the same threats that are driving the Yangtze River dolphin toward extinction. "Asia's large rivers have been ravaged and impoverished by human overuse and misuse, leading to enormous losses of wildlife," says Randall Reeves, chairman of the World Conservation Union's (IUCN) Cetacean Specialist Group. Likewise, the Amazon River dolphin is vulnerable because South America's rivers are being used more and more as the human population grows.

Despite their far-flung distribution, these four river dolphins have a lot in common. They generally look alike and prefer the same types of habitats in rivers. One of their most striking features is a long, slender snout, which is lined with as many as 150 sharp, pointy teeth. River dolphins also have small eyes, and those that live in the Indus and Ganges Rivers are essentially blind because their eyes lack lenses. River dolphins don't need eyesight to navigate and hunt because they have well-developed sonar systems, allowing them to live in water so turbid that they couldn't see anyway.

Compared to their streamlined marine cousins, river dolphins are stockier and have tiny dorsal fins and broad, paddle-like flippers and flukes. They are also slower and typically swim at about one mile per hour, which is roughly a fifth of the cruising speed of marine dolphins. River dolphins have traded speed for far greater maneuverability, allowing them to swim in shallow, narrow waterways and so make the most of their riverine habitat. Notably, the Indus and Ganges river dolphins can swim in water that is only a foot deep.

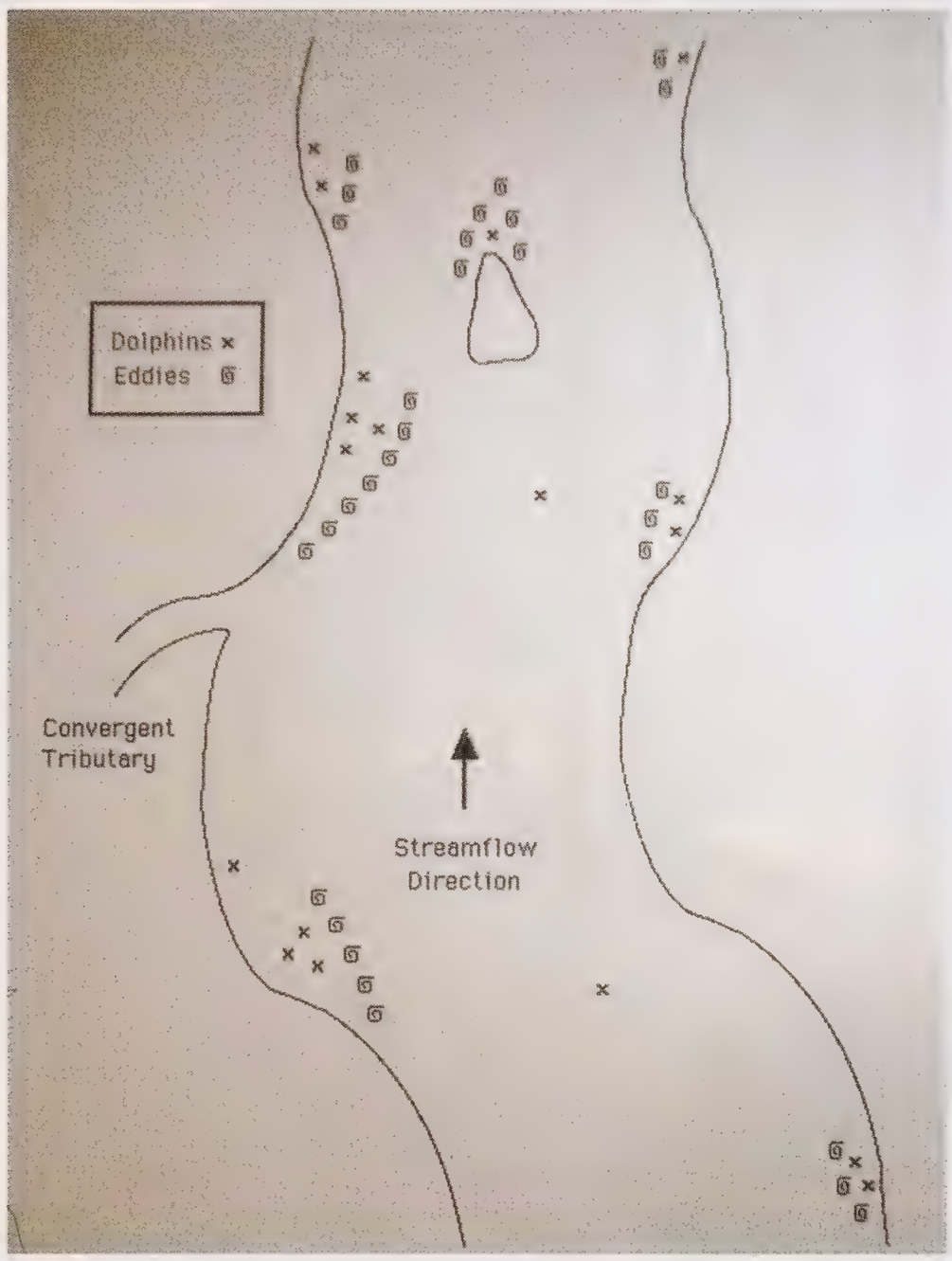
Given the choice, however, river dolphins prefer deeper water and particularly favor counter-current pools, or eddies, that provide refuge from the swift currents of rivers. "They live in a constant current so they take advantage of places like bends and confluences of rivers where the flow is slower," says Reeves. Another attraction of counter-current pools is that they are rich in fish, the dolphins' primary prey. "Counter-current areas are biological 'hotspots' within large Asian rivers," he says.

Similarities notwithstanding, genetic evidence suggests that each river dolphin species evolved independently. River dolphins are far more primitive than modern marine dolphins, and the Indus and Ganges river dolphins are among the most primitive mammals alive today. According to their 2001 paper in *The Royal Society Proceedings: Biological Sciences*, Healy Hamilton and colleagues calculated that river dolphins began evolving at least 15 million years ago.

During this time, sea levels were globally high and the scientists suggest that the timing of these two events was no coincidence. The high seas flooded low-lying regions of continents, forming extensive inland seas, and the story goes that ancient marine dolphins moved into these inland seas and then remained in—and adapted to—rivers when sea levels fell again. Fossil evidence shows that river dolphins were once more widespread than they are today, concentrated in relatively warm coastal regions in North America, in what is now southern California, Florida, and Maryland, as well as in Argentina.

The very thing that makes these dolphins so fascinating—the fact that they live in rivers—is also their biggest problem. Adapted to live only in rivers, river dolphins have nowhere else to go when their habitat is destroyed or degraded to control flooding, provide irrigation water and hydropower, or facilitate boat traffic. "The extreme specialization of the species puts them at great risk—by accident of birth, they're in trouble," says Reeves.

© GILL BRAULIK



A SCHEMATIC DRAWING THAT SHOWS RIVER EDDIES, WHERE ASIAN DOLPHINS PREFER TO LIVE AND HUNT.

The main threats to river dolphins include: dams, which fragment their habitats and deplete the water; fishing, which often accidentally kills dolphins too; boats, which collide with and kill dolphins and make noise that can interfere with their sonar; and pollution, which degrades the water the dolphins live in. "They all face similar threats. Living in rivers puts them in such close proximity to people because rivers are so heavily used by people," says Gill Braulik, who like Reeves is in the World Conservation Union's Cetacean Specialist Group.

YANGTZE RIVER DOLPHIN: THE BAIJI

The Yangtze River dolphin is called the baiji, which means "white dolphin." An estimated 5,000 once lived in the middle and lower reaches of the river from its mouth at Shanghai to Three Gorges. Traditionally revered as a river goddess, the baiji's numbers dropped dramatically in the late 1950s, as it was hunted for food and hides during China's "Great Leap Forward." There was even a factory specializing in baiji skin gloves and handbags, but it soon closed because the dolphins became too scarce.

The baiji has been legally protected since the 1980s, and three parts of the Yangtze were designated reserves. Even so, the species continued to decline steadily from about 400 individuals in 1984 to 200 in 1990. In 1995, biologists tried to catch the remaining baiji and put them in a 12-mile-long reserve in an oxbow near Wuhan, in central China, where they would have been relatively easy to protect. But in six months of searching, the biologists saw only seven of the dolphins and managed to catch only one. Today, there are probably fewer than 50 left, making the baiji one of the most endangered species in the world.

The most immediate threats to the baiji include deaths from boat collisions, underwater blasting during harbor construction, and three illegal—but widely used—fishing methods: electrofishing, explosives fishing, and rolling hooks. The latter method entails the use of tens of thousands of long lines, each set with thousands of hooks to catch larger fish that inhabit the river bottom.

The baiji shares its habitat with hundreds of millions of people. At nearly 4,000 miles, the Yangtze is the third-longest river in the world and its basin is home to well more than a tenth of the people in the world. The Yangtze is used extensively for agriculture, industry, and transportation. In 1990, boat traffic rates in the river's lower reaches exceeded one per minute. In addition, most sewage and industrial and agricultural wastewater are discharged directly into the river without treatment. "The degradation of the Yangtze continues unabated," says Reeves.

The baiji has been largely written off by conservationists, who expect it to die out within a few decades despite their hard work to save it. "The baiji's imminent extinction is a national tragedy and an international disgrace," says Reeves.

Even so, some good may come of the baiji's all-but-certain demise. "The fate of the baiji is an early warning system for other river dolphins," says Braulik of the Cetacean Specialist Group.

INDUS RIVER DOLPHIN: THE BHULAN

Braulik recently surveyed Pakistan's Indus River dolphin, which is called the bhulan, and he estimates that there are about 1,100 left. "Pakistan is starting from a better position than China—the numbers are high enough that we could actually do something to help them," she says.

One reason for the bhulan's relative abundance is that more than 95 percent of Pakistan's people are Muslim, and Islamic law forbids consumption of dolphin meat. "This probably helps explain why the Indus dolphin has survived as long as it has," says Reeves. Other reasons include that the Indus has no large cities on its banks, is not heavily fished, and has few motorboats, because most goods are transported on roads.

FISHERMEN NAVIGATE THE INDUS RIVER, RIVER-DOLPHIN HABITAT.

Top: Eye lenses are nonexistent in the Yangtze river dolphin, and would be an evolutionary extravagance in murky river waters. Instead, river dolphins use their highly evolved echolocation as an extremely effective means of communicating, navigating, and hunting. (Sound travels four times faster through water than in air, and over great distances.)

Middle: The vessel used during a survey of Indus River dolphins, March 2001.

Bottom: A boat from Indus Eco-tourism Programme under sail with American tourists, Pakistan.

Despite these factors in its favor, the bhulan faces a formidable threat. Its habitat has shrunk to a fifth of its historic size, which once stretched about 2,000 miles from the mouth of the Indus to the Himalayan foothills and included four huge Indus tributaries. The dolphin's competition is the intensive agriculture in the arid Indus plains that has driven construction of the largest continuous irrigation system in the world. Since 1932, Pakistan has built about 25 dams and barrages, which are gated dams that divert water into irrigation canals, and more than two-thirds of the Indus' flow is now diverted. "For almost half of the year, no water reaches the delta," says Braulik. "The river becomes a sea of sand."

The barrages keep the bhulan from traveling freely, isolating populations from one another. Dolphin populations trapped upstream of barrages typically die out, and today only a few of the remaining populations are big enough to have a chance of surviving, with the largest estimated at 600 and the smallest at only 70.

Bhulans also get trapped in irrigation channels. They swim through the open gates during the monsoon season only to become stranded as the water levels drop during the dry season. The dolphins can swim as far as 90 miles down tiny canals through the desert. Braulik estimates that irrigation canals trap 12 to 15 bhulans per year from the largest population, which may be more than it can sustain. The local wildlife department has recently been rescuing the bhulan from canals and transporting them back to the Indus. "You put them on a stretcher, protect them from the sun, and use sponges to keep their skin wet. Transport can take as much as seven hours because we often have to travel on unpaved roads through desert," says Braulik.

Another positive development for the bhulan is ecotourism along the Indus. A local nongovernment organization called the Adventure Foundation of Pakistan is sponsoring boat tours down the river to see bhulan and other wildlife, including cranes, flamingos, otters, and turtles. These tours are led by fishing families who live on the river and encourage other local fishermen to release bhulan that get caught in their nets.

Ultimately, however, the bhulan's survival will depend on the animals' having enough water to live in. Braulik would like to see a minimum amount of water allocated to the Indus for the dolphins, but acknowledges that this may be difficult. "There is just not enough water to go around in Pakistan. Any river water that reaches the sea is viewed as wasted, so it's hard to do anything," she says. In the meantime, the best that conservationists can do is to continue monitoring the species to see if the population drops further—and, of course, to try to do something about it if it does.

© GILL BRAULIK

©NICK GORDON / ARDEA LONDON

© GILL BRAULIK

© GILL BRAULIK

© GILL BRAULIK

ABOVE: A YOUNG INDUS RIVER DOLPHIN BEING MEASURED AFTER ITS RESCUE FROM AN IRRIGATION CANAL.

LEFT: THE MARSH CROCODILE (*CROCODYLUS PALUSTRIS*) IS BETTER ADAPTED TO MAN-MADE FEATURES LIKE CANALS AND RESERVOIRS THAN DOLPHINS ARE.

RIVER DOLPHINS ARE FAR MORE PRIMITIVE THAN MODERN MARINE DOLPHINS, AND THE INDUS AND GANGES RIVER DOLPHINS ARE AMONG THE MOST PRIMITIVE MAMMALS ALIVE TODAY.

GANGES RIVER DOLPHIN: THE SUSU

Estimated to number roughly a few thousand, the Ganges River dolphin or susu is doing slightly better than the closely related bhulan. But this does not mean that the threats to the susu are any less severe. Rather, this species is more abundant because its habitat is far more extensive. Susus are still found in much of their historical range in the Ganges–Brahmaputra–Megna River system in India, Bangladesh, and Nepal, and the Karnaphuli River system in Bangladesh.

Like the baiji, the susu faces many threats. Among the worst are dams, fishing-related deaths, and hunting. About 50 dams and barrages have fragmented the susu into perhaps 20 populations. As in Pakistan, "groups of dolphins upstream of dams and barrages have either disappeared or declined with little prospect of recovery," says Reeves.

The susu is all but gone from Nepal, where barrages have essentially eliminated the dolphins from three of the four rivers where they once lived. Today, only the Karnali River has a population large enough to have a chance of surviving, and its prospects are not good. One reason is that yet another dam is planned, this one on the Karnali itself. "We believe that this population will soon go extinct in the absence of conservation action," wrote Indian zoologist Ravindra Sinha and his colleagues in a 2000 IUCN report called "Biology and Conservation on Freshwater Cetaceans in Asia."

In India and Bangladesh, the susu also is threatened by heavy gillnet fishing and hunting. Gillnet fishing both depletes the species' prey and kills the dolphins directly. Dolphins have a hard time detecting the fine nylon gillnets and, once ensnared, cannot break free, so they become entangled and soon drown. Furthermore, although the susu is legally protected from deliberate killing throughout its range, fishermen in some parts of India and Bangladesh still hunt the dolphins for their oil, which they mix with goat fat to create a concoction used to lure fish.

Without active protection, the susu is likely to go the way of the baiji. "The greatest lesson of the baiji may be that early conservation action is required before a [species] has reached an irreversible threshold of decline," wrote Sinha and his colleagues.

As a first step, they advocate strengthening the susu's protection in its only reserve. A 30-mile segment of the Ganges in Bihar, a province in northwest India, was declared a sanctuary in 1991, but fishermen still hunt susu and accidentally kill them in fishing nets there. Sinha and others are working to "transform the sanctuary from one that exists only on paper to one that provides effective protection to dolphins."

AMAZON RIVER DOLPHIN: THE BOTO

The Amazon River dolphin is called the boto or the pink river dolphin—and some of them are actually bright pink. Their numbers are unknown, but the boto has an enormous range in the Amazon and Orinoco river basins, which together encompass 2.7 million square miles. The boto enjoys vast stretches of rivers that remain

Continued p. 17

THE DOLPHIN–HIPPO CONNECTION

SUSAN LUMPKIN

At first thought, it seems a stretch that cetaceans—dolphins, whales, and porpoises—and hippopotamuses come from the same branch on the tree of life. True, hippos spend much of their time submerged up to their snouts in rivers, but they feed on land, as no cetaceans do, and their bulbous bodies bear little resemblance to the cetaceans' sleek, streamlined forms.

Moreover, hippos are members of the mammalian order Artiodacytla—the even-toed ruminant ungulates—a group that includes deer, cows, sheep, antelope, and the like. Cetaceans are . . .? Well, we know they are not fish. Although people long labeled them fish, Aristotle recognized that dolphins were not fish, although he did not associate them with land-living mammals, which he called quadrupeds. Linnaeus, father of modern taxonomy, officially classified them as mammals in 1776. According to biologist Phil Clapham, in *Whales of the World*, the Swedish naturalist solemnly stated: "I hereby separate the whales from the fish." And that was that.

Knowing that mammals evolved on land raised questions about which land animals the cetaceans evolved from. On morphological grounds, from comparative analysis of the bones of fossil and modern mammals, scientists concluded that cetaceans were related to ungulates. Artiodactyls are ungulates; so too are horses, rhinos, and other members of the Perissodactyla (odd-toed ungulates), and some extinct groups. Traditionally, elephants (Order Proboscidae), hyraxes (Order Hyracoidea), and manatees and dugongs (Order Sirenia) are included in the ungulates as well. However, it was not clear which ungulates were the cetaceans' next of kin.

Recently, two opposing views emerged, one based on morphology and one based on molecular genetic evidence. The morphologists, looking at the ankle bones of fossils of early whales, artiodactyls, and an extinct group called the mesonychians, argued that the cetaceans were "sister taxa" to the mesonychians, which were land-living carnivorous ungulates. Sister taxa, in the jargon of stystematics, share a common ancestor.

Genetic evidence painted a different picture, instead showing that cetaceans were most closely linked to the artiodactyls, and, more specifically, were sister taxa to the hippopotamuses. Today, only two species of hippos survive, both in Africa, but the family Hippopotamidae once included more species in Africa as well as Europe and Asia.

Now, new fossils have emerged that tend to support the genetic results. These fossil cetaceans from Pakistan were first to be found with ankle bones—and the form of the fossil cetacean ankles matches the unique form of artiodactyl ankles. This confirms, at least, that cetaceans are artiodactyls—the group has been called "cetartiodactyla" —but morphologists aren't ready to concede the cetacean–hippo connection because fossil evidence is still lacking.

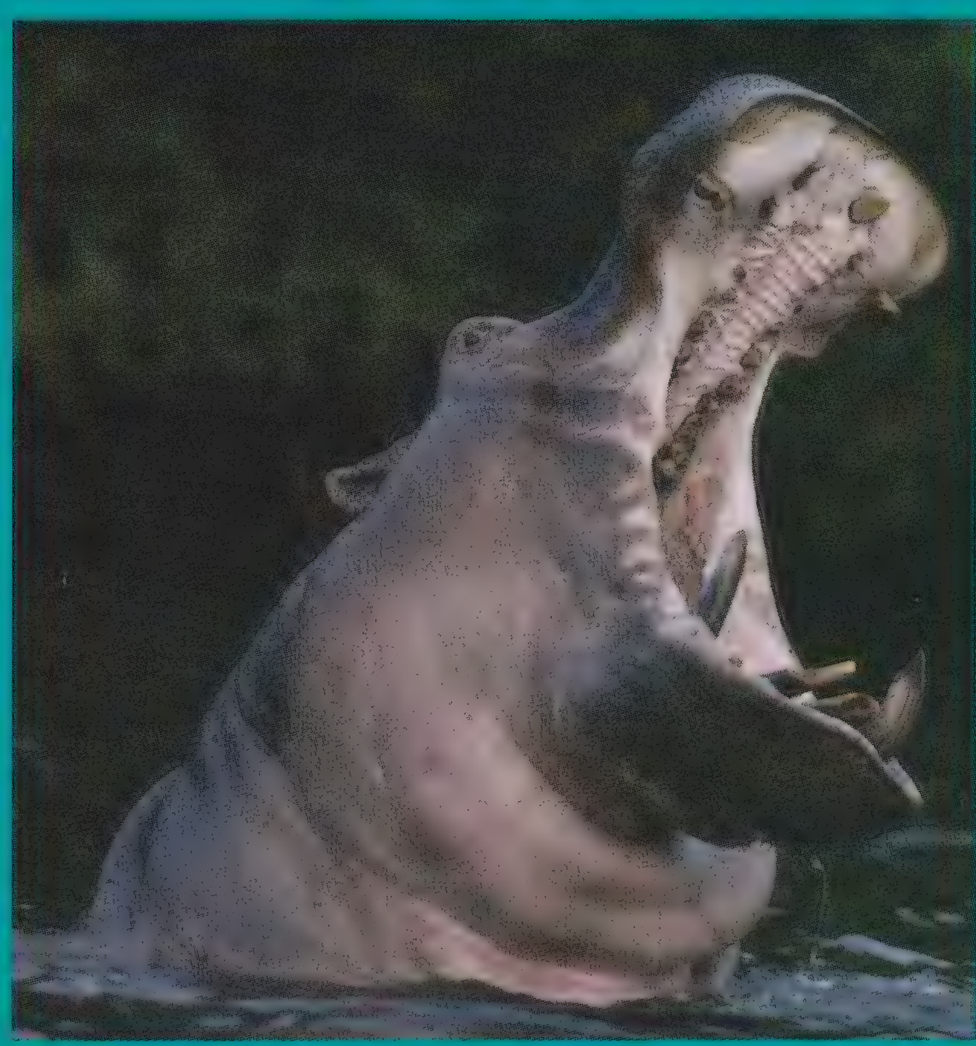
To bolster their case, molecular biologists point to similarities among modern cetaceans and hippos. Animals in both groups lack hair and sebaceous glands, and both are capable of vocalizing underwater. These were once believed to be the result of the two groups' evolving similar adaptations to aquatic environments, but it may turn out that the similarities are due to their sharing a common ancestor.

Molecular biologists are actually re-casting the relationships among all the mammals in light of genetic analyses, with some surprising, not to mention controversial, results. They divide the mammals into four large groups, whose divisions can be related to the location of continents in geological time.

Elephants, hyraxes, and manatees and dugongs have been split from the other ungulates, and lumped with aardvarks, golden moles, tenrecs, and elephant shrews to form a group dubbed Afrotheria. The group's origins are believed to be African because the earliest fossils were found there and some, such as the elephant shrews, never left. More certainly, their origins are in Gondwana, the supercontinent that once consisted of Africa and South America and other southern-hemisphere land masses. The Afrotheria may have included the first true mammals. Also originating in Gondwana, and perhaps left behind when Africa and South America broke apart, is the group called Xenartha, the armadillos, anteaters, and sloths that are confined to South America.

A third group, the Laurasiatheria, is so named because they were first found in Laurasia, the conjoined northern-hemisphere landmass of North America, Europe, and Asia. This groups includes cetartiodactyls, perissodactyls, carnivores, pangolins, bats, and insectivores. Finally, the Euarchontoglires unites rodents, rabbits, tree shrews, flying lemurs, and primates—also with northern-hemisphere origins.

The ancient Greeks had different ideas about the origins of dolphins. In one myth that explains dolphins' apparent affection for people, the god Dionysus transformed evil men into good dolphins. Dolphins symbolized the benign aspects of the ocean and, in several myths, a dolphin rescues a drowning person. The god Apollo, appearing in the form a dolphin, led a ship out of danger and named the sailors priests at his temple in Delphi (*delphis* is the Greek word for dolphin). Some South American myths give dolphins the ability to turn into people and help cure the sick; others claim that dolphins inherit the souls of the drowned. While science puts rats and rabbits among our nearer relatives, undoubtedly many of us would prefer the mythical alliance with intelligent, attractive dolphins, an unusual case of water being thicker than blood.



CARLTON WARD, JR.

HIPPO FROM GABON.

©PAT MORRIS / ARDEA LONDON

THE AMAZON RIVER DOLPHIN'S LOST AND FOUND NAMES

SUSAN LUMPKIN

In the 18th and 19th centuries—the heyday of Western biological exploration—many new species were named for the intrepid adventurers who combed the Earth in search of specimens for the museums of Europe. From China, French missionary Pére David sent the first Pére David's deer to Paris and the species was named *Elaphurus davidianus* in his honor. Likewise, Russian explorer Nikolai Przewalski's horse, *Equus callabus przewalskii*, Eld's deer, *Cervus eldi*, and many others.

So when the Amazon River dolphin's scientific name turns out to be *Inia geoffrenis*, and this character Geoffroy also appears in the names of Geoffroy's cat, *Oncifelis geoffroyi*, Geoffroy's marmoset, *Callithrix geoffroyi*, Geoffroy's tamarin, *Saguinus geoffroyi*, and a spider monkey, *Ateles geoffroyi*—South American species one and all—it would seem safe to assume that Geoffroy had spent time scouring South America for new species. In fact, a reliable website on cetaceans states that Geoffroy found the river dolphin type specimen and called it *Inia* for the local name of the animal. In fact, this is wrong.

Etienne Geoffroy Saint-Hilaire, to give him his full name, was never in South America. He neither discovered or named any of these species (although he did describe and name many, many others). These species, and more—from an Australian brain coral to a Papua New Guinea beetle and a genus of Australasian parrots—were named for Geoffroy, a towering figure in 19th-century biology. He was appointed to the first chair of zoology at the Paris Museum National d'Histoire Naturelle when the museum was founded in 1793 and remained a power in the museum until his death in 1844. He also supervised the menagerie of the Jardin des Plantes, forerunner of the Paris Zoo. But he is best known for his doctrine of "unity of composition," which held that there was a single anatomical plan common to all vertebrates—and perhaps to all animals. This was in contradiction to the view that the Creator provided species with functional adaptations to suit their needs, and later proved influential to Darwin's thinking about evolution through natural selection. Today, evolutionary biologists still cite the unity of composition as evidence of the relationships among diverse species, although, unlike Geoffroy, they stress equally the unity of function.

Geoffroy did not find the type specimen of the Amazon River dolphin in South America. He did, however, bring it to Paris from a foreign country under unusual circumstances. European imperial aspirations in the 18th and 19th centuries meant not just conquering and colonizing foreign lands but also plundering their wealth of all types, including their biological treasures. Museums filled with specimens from far-off places symbolized imperial power. So when Napoleon's army invaded Portugal in 1810, the emperor sent Geoffroy to Lisbon, with orders to take possession of the collections of the Museu da Ajuda for France. Geoffroy obliged and returned to Paris with, among other items, more than 400 specimens that had been collected in the first scientific exploration of the Rio Negro in Brazil by one Alexandre Rodrigues Ferreira, along with Ferreira's written documentation of his trip.

Born in Brazil in 1756, Ferreira was educated as a naturalist in Portugal and worked in the Lisbon museum before the Portuguese government sent him back to Brazil in 1783 to explore the interior of its vast South American colony. He spent nine years at it, describing and collecting plants and animals, as well as recording his observations on the indigenous people. He then returned to Portugal, and lodged his trove in the museum that was later plundered by Geoffroy.

Among Ferreira's expropriated specimens was one of an Amazon River dolphin, which he classified as *Delphinus delphis*, the name Linneaus had given to the common dolphin. This specimen, along with his notes and drawings, ended up in Paris, where the species was redescribed in 1817 by Henri Ducrotay de Blainville, a younger colleague of Geoffroy. De Blainville called the animal *Delphinus geoffrensis*, thus giving credit not to its discoverer, Ferreira, but to the man who had it shipped from Portugal to France. (Likewise, Geoffroy's tamarin, *Saguinus geoffroyi*, was a Ferriera find.)

Later, in 1834, French scientist Alcide d'Orbigny created the genus *Inia* to describe a river dolphin specimen he collected in Bolivia, calling it *Inia boliviensis*. And finally, in 1856, yet another Frenchman, Paul Gervais, recognized that *Delphinus geoffrensis* rightfully belonged to the genus *Inia* as well, and when the two were lumped into a single species, the name *Inia geoffrenis* was retained. Alcide d'Orbigny and Paul Gervais also honored de Blainville by naming the franciscana, a coastal South American river dolphin *Pontoporia blainvillei*, and Geoffroy by naming Geoffroy's cat.

Similar to Ferriera, d'Orbigny was sent to explore South America on behalf of France and spent seven years there. In *The Voyage of the Beagle*, Darwin mentioned his remarkable efforts: "When at the Rio Negro, we heard much of the indefatigable labours of this naturalist. M. Alcide d'Orbigny, during the years 1825 to 1833, traversed several large portions of South America, and has made a collection, and is now publishing the results on a scale of magnificence, which at once places himself in the list of American travellers second only to Humboldt."

In an eerie echo, an encyclopedia reference on Ferriera reads, "On account of the energy and skill with which he conducted his investigations [of the Amazon] he became known as the Brazilian Humboldt." A German, Alexander von Humboldt explored South America from 1799 to 1804, and then spent 22 years writing 30 volumes about his experiences, for which he remains famous today. (In what sounds like a bit of scientific back-scratching, Geoffroy named a wooly monkey after Humboldt, and Humboldt named a marmoset after Geoffroy.) With Gervais, d'Orbigny described many of his own new species, and went on to scientific acclaim as a founding father of paleontology.

And Ferriera? Although his later career paralleled that of Geoffroy—he was director of Lisbon's natural history museum and botanical garden from 1793 until he died in 1815—today he merits barely a footnote in the history of either exploration or science. Ferreira's scholarly writing seems to have been lost, but for one long-neglected manuscript that was finally published in 1972. And, while the official describers of species will be forever credited in formal scientific writing as in, for example, *Inia geoffrensis* de Blainville, there is no *Inia delphis* Ferriera as, by right, the species should be known.

Or maybe not.

In a final twist, two scientific descriptions of the Amazon River dolphin that appeared before Ferriera's were reported in 1997. One was by a Portuguese priest, Frei Cristovao de Lisboa, who traveled in Brazil between 1624 and sometime between 1627 and 1631. He called the animal a sea-pig and listed it a fish, but his description is accurate and his drawing is clearly of a river dolphin. His original manuscript on the natural history of the Amazon in which the description appears, dated 1647, was lost until 1934, and not until 1967 was a facsimile edition produced.

The second description was by a Swede named Pehr Löfling, who was a student of Linneaus. He was commissioned by Spain in 1755 to explore South America in search of useful natural products. He died less than a year into his journey, but not before he described and sketched what he called *Delphinus tonina*, tonina being the common name used by local Spaniards for the river dolphin. Löfling's papers were returned to Spain, from which a few were recovered by Linnaeus, who published some of his botanical work, others were lost, and many remained unpublished in Spanish archives, including the tonina description. Had he known of this work, Linnaeus would certainly have included the species in later editions of his *Systema Naturae*.

free of dams and pollution, and is found all along the rivers from the deltas to the headwaters, where impassable waterfalls limit its range.

But things are changing in the Amazon. More people are settling along the rivers as the human population grows, making the boto increasingly vulnerable to the threats that have endangered the Asian river dolphins.

The boto was traditionally protected by legends that it had supernatural powers. Although botos are quite playful—they grasp fishermen's paddles, rub against canoes, and throw sticks—local people were afraid of them. "Many river-dwelling people in Peru regard the animal with superstitious dread, fearing that handling it will precipitate a long series of retributive consequences for them and their families," says Reeves. "Dolphin hunting is in some sense taboo in much of Amazonia."

Unfortunately for the boto, these beliefs are disappearing and recent settlers in the Amazon often see the dolphins as competitors for fish. Local people report that some fishermen now poison botos by tossing them fish injected with an agricultural insecticide called methyl parathion. Accidental boto deaths are also rising as nylon-gillnet use and dynamite fishing become more widespread. Pollution is increasing as well, and the milk of female botos in the upper Amazon contains pesticides and mercury.

Perhaps worst of all, the Amazon is likely to get more dams. There are plans to build hydroelectric dams on many Amazon tributaries and on the Orinoco, and to build a system of dams and locks on the Orinoco that would make the river navigable year-round.

CONSERVING RIVER DOLPHINS

Despite the dangers river dolphins face, hope remains for those in the Amazon, Indus, and Ganges. One way of conserving river dolphins is to establish meaningful reserves by setting aside areas the dolphins favor and enforcing bans on harmful fishing methods and boat traffic. Another way is to improve water quality by treating industrial waste and sewage and decreasing agricultural pesticide runoff.

© GILL BRAULIK

RESEARCHERS RELEASE A RIVER DOLPHIN IN PAKISTAN DURING A SURVEY.

Conservationists also recommend making dams and other water developments more environmentally friendly. This might actually happen. Thanks to the growing awareness of the considerable environmental costs of dams, the World Bank, which funds many large dam projects, now stresses that water-development projects should include components to conserve biodiversity. There are two ways to make dams less harmful to river dolphins. One is to build them near the headwaters, which leaves longer stretches of uninterrupted river habitat. The other way is to concentrate the dams on one river, which leaves other rivers free of them altogether.

Most important, people need to realize that there is a limit to what rivers can provide. "Our freshwater resources are exhaustible and a river's capacity for serving human needs is finite," says Reeves. That also goes for serving the needs of the dolphins as well as the many other creatures that live in rivers.

—Robin Meadows is a freelance science writer based in California and a contributing editor to ZooGoer.

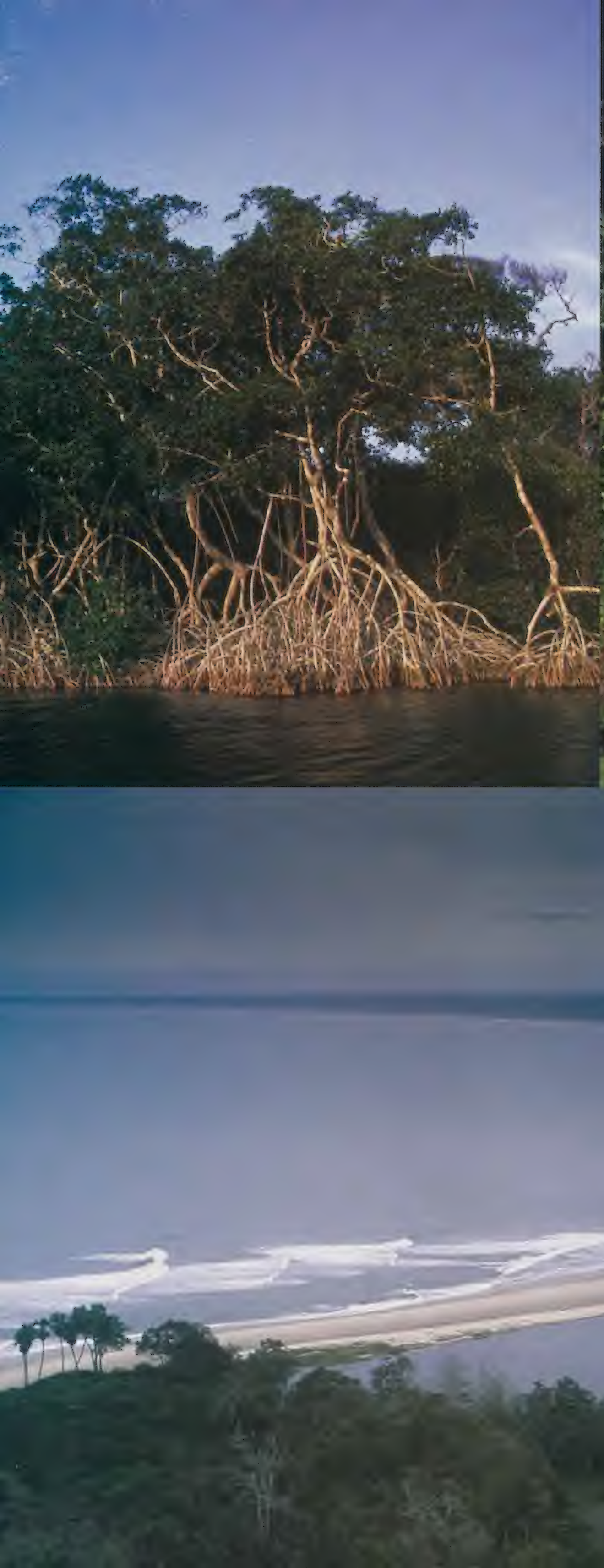
teeming in Gab

Life on Gabon's Rainforest

It's 5:00 A.M.

We have already finished a quick breakfast and are beginning a long day in the field. We move out from camp along winding trails, laden with the supplies of modern-day scientists: binoculars, global-positioning-system units, waterproofed notebooks, and such. We also carry with us the respect that people have acquired for this region over thousands of years. This is elephant, gorilla, leopard, and crocodile country. This is Gabon's tropical rainforest—primeval jungle, an environment that sustains thousands of species, including *Homo sapiens*, and some that are dangerous to humans.

It must be entered with care.



LEFT: A MOSAIC OF HABITATS, INCLUDING COASTAL AREAS (BOTTOM), LAGOON, MANGROVES (TOP LEFT), AND RAINFOREST (TOP RIGHT). THESE DIVERSE HABITATS DEFINE THE UNIQUE NATURE OF GABON'S COASTAL LANDSCAPE.

RIGHT: PARATAXONOMISTS ARE TRAINED RESEARCH ASSISTANTS WITH NO PREVIOUS EXPERIENCE; THESE FROM CONGO SAMPLE FISH IN A COASTAL LAGOON IN GAMBA.

BY FRANCISCO DALLMEIER, ALFONSO ALONSO, PATRICK CAMPBELL, AND MICHELLE LEE

PHOTOGRAPHY BY CARLTON WARD, JR.

Specifically, this is Gabon's Gamba Complex, more than 11,000 square kilometers (4,247 square miles) of tropical rainforest bordering the Atlantic Ocean and extending inland up to 100 kilometers (62 miles). This region boasts an incredible mosaic of habitat types that includes beach and sand dunes, littoral forest, mangrove forest, freshwater swamp, lowland seasonally flooded forest, upland nonflooded forest, open grassland, and extensive lagoons and lakes adjacent to the ocean. Further inland, expansive tracts of upland forest are sometimes dissected by lowland, seasonally flooded forest along rivers and larger streams. The entire area may represent a transition zone between the Guineo-Congolian tropical forest zones and savanna ecosystems to the south. That makes the Gamba Complex extremely important habitat for numerous resident and migratory species.

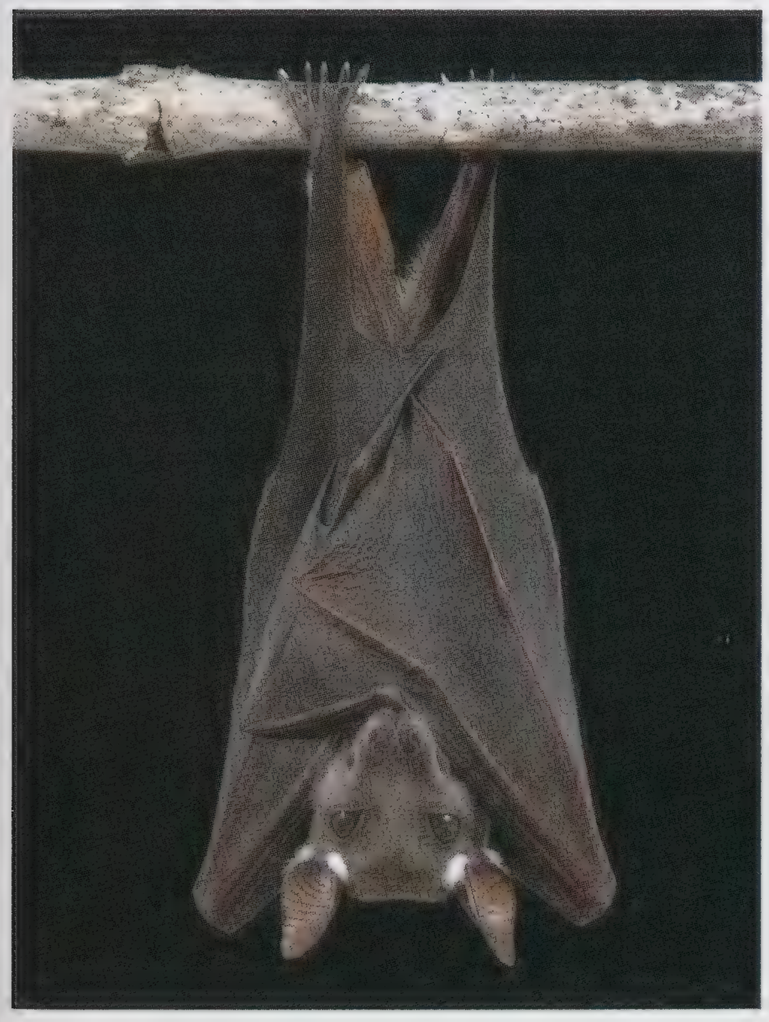
As part of the Smithsonian National Zoo's Monitoring and Assessment of Biodiversity Program, we are privileged to head up a team of more than a dozen Smithsonian and international scientists, along with Gabonese researchers and "parataxonomists," in an exciting multi-year biodiversity research and conservation project. We are documenting for the first time ever the rich variety of species and habitats—the biodiversity—of this region in west central Africa.

Scientists usually speak of biodiversity at several levels. Those interested in a single species might look at genetic variability within that species or the diversity of populations of that species. At a larger scale, biologists may catalog the number of different species found in a habitat type, known as species richness, or the different habitat types in an area. All of these studies contribute to biodiversity research, and the results provide useful information to manage and conserve the species or habitats in question.

In areas like west central Africa, where little research has been done, we started our work at the larger scale. Thus, we are attempting to describe habitat types and assess the different species found in those habitats in the Gamba Complex. The information we are gathering characterizes the area's habitat types and documents the distribution of species in the field.

This baseline information is essential to in-country resource managers as well as to scientists in zoos and other conservation settings working to conserve rare or endangered species. The more we know about natural habitats and the behavior of species in those habitats, the more we can do to conserve elephants, big cats, monkeys, chimpanzees, birds, reptiles, and other creatures that attract millions of curious visitors to the National Zoo and thousands of other zoos worldwide. That knowledge also helps us to create strategies for protecting imperiled species such as gorillas—both in the wild and in zoos—and helping their populations recover.

Most of our initial research in Gabon has revolved around the question: What species are here and how can we collaborate with governments, industry, and other organizations to promote long-term conservation of those species? Our international researchers are experts in taxonomy, the science of classifying organisms in an ordered system that indicates evolutionary relationships. And they are adept at biodiversity studies that record all organisms—from large,



EPOMOPHORUS SP., A BAT COLLECTED IN RABI.

DWARF CROCODILE (*OSTEOLAEMUS TETRASPIS*).

AN UNIDENTIFIED FUNGUS FROM RABI.

charismatic species to small, elusive ones—and open doors to more specific ecological questions such as: Which snakes are active at night? Where are groups of gorillas nesting? What does today's forest structure tell us about its history? How do these factors interact?

We are currently working to answer these questions about the Gamba Complex, and it is important to do so. The complex overlays vast oil reserves that have been a major source of economic activity in Gabon for more than 40 years. We initiated a partnership with Shell Gabon, one of the main companies operating in the complex's oil fields, to provide sound biodiversity baseline information and to work with company personnel to integrate research findings into decisions related to both ongoing and future development of oil fields. This partnership also includes disseminating these results to all stakeholders through consultation meetings, briefing papers, scientific and popular publications, and regular updates on websites. We anticipate that the work will continue over the long term as biodiversity monitoring activities are carried out in different parts of the complex.

So far, our teams of experts have finished baseline studies at five locations: Rabi, where oil fields are in operation; Toucan, a relatively untouched area where oil operations are just beginning and where we have the opportunity to conduct research in the early stages of development; Loango and Moukalaba-Doudou, two recently established national parks; and Gamba, where oil operations have been in place for 40 years and small towns exist. Our work takes place during what we call the dry and rainy seasons in this tropical forest, although to most of us in the United States both seasons would be considered rainy (and hot, and steamy).

We are amazed at the results so far. The vast storehouse of biodiversity in the Gamba Complex is exceeding our expectations, and the knowledge we are gaining should have a tremendous impact on the conservation of rare species in their natural habitats, as well as in living collections at zoos.

A PLETHORA OF PLANTS

Our botanists have established 75 biodiversity research plots, each 0.1 hectare in size (about one-quarter acre), throughout Rabi, Toucan, Loango, and Moukalaba-Doudou. In the plots, researchers record the size and type of trees and enter these data into computers using software developed especially for this type of work. These data allow scientists to describe the various habitats by composition (the most common species) and

A REED FROG (*AFRIXALUS DORSALIS*).

A FAMILY OF THREE ELEPHANTS (*LOXODONTA AFRICANA*) FORAGES AMONG THE COASTAL SCRUB NEAR THE BEACH IN LUANGO NATIONAL PARK, WHERE THEY GENERALLY WERE OBSERVED IN THE LATE AFTERNOON.

structure (the relative size and distribution of the trees).

The vegetation team has assessed tree diversity in the plots scattered throughout the Gamba Complex. They recorded more than 7,000 trees, measuring five centimeters (about two inches) or more in diameter, of at least 300 different species. They also collected hundreds of specimens of fruits or flowers for the botanical collections of international herbaria, where the public can view many of them and where scientists will conduct more studies to discover any secrets the plants hold. Remember, many of the pharmaceuticals we use today had their origins in wild plants.

As Dr. Henri Bourobou-Bourobou of l'Herbier National du Gabon says, "The Gamba Complex is rich most likely because it is very remote and thus relatively untouched by logging and other extractive activities. The canopy averaged 40 meters [130 feet] in height with the big trees that characterize a mature community, including *Coula edulis*, *Diogoa zenkeri*, and *Santiria trimera*." Chimpanzees use wooden clubs and stones to break open nuts of the *Coula* trees, sometimes called Gabon nut trees, to extract the edible kernel; other primates eat the fruits of the *Santiria*, also known as the African walnut.

Analyses of preliminary data from all sites describe a dynamic, old-growth forest where tree fall gaps are common. "This allows for a mix of both early and late successional species," explains Bourobou-Bourobou. "Lianas are abundant everywhere, and along with early successional species, they are often indicators of disturbance. But we believe most disturbance in this forest environment is from natural causes. There is evidence of selective logging in only a few localized areas. When all of the tree species are eventually identified, we will be able to examine the spatial aspects of vegetation in the complex to gain insight about the dominant species. We can then relate that information to the resource needs of animals in the region and add to knowledge about any rare species that may be vulnerable to human activities."

WHAT'S IN THE WATER

The aquatics team studying fish in the complex expected to record between 40 and 50 species, based on studies in similar habitats elsewhere in Gabon. "We were surprised and very pleased to find 70 species so far," enthuses Jean-Aimé Yoga of Gabon's Institute for Research and Forest

A LEGLESS SKINK (*FEYLINIA GRADISQUAMIS*).

VEGETATION TEAM SURVEYS A NEWLY CUT ROAD THROUGH THE RAINFOREST NORTH OF RABI, WHERE NUMEROUS VEGETATION-ASSESSMENT PLOTS WERE SET UP.

WHAT SPECIES ARE HERE AND HOW CAN WE COLLABORATE WITH GOVERNMENTS, INDUSTRY, AND OTHER ORGANIZATIONS TO PROMOTE LONG-TERM CONSERVATION OF THOSE SPECIES?

Agronomy. "What this means is that the Gamba Complex may well be a 'hot spot' for fish diversity." Jean-Aimé and the other members of the aquatics team spend hours encased in high waders as they explore the lagoons, lakes, streams, and rivers of the complex. Using large gill nets for deep water, beach seines for shallow areas with sandy or muddy substrate, dip nets for small creeks, and occasionally a hook and line, they are building a solid baseline of information. Their work at 27 different sampling stations in the Mbari, Echira, and Rabi Rivers is the first-ever fish survey conducted for these three river systems.

The team recorded several interesting species, including *Polycentropsis abbreviata*, a rare leaf fish that stalks prey by camouflaging itself as a leaf floating in the water, and seven species of electric fishes in the family Mormyridae—two of which, it appears, may be new to science. The team explains that it is likely that another one or two specimens from other fish groups may also be new, but it will take more investigation to be certain.

NEW AND EXCITING HERPS

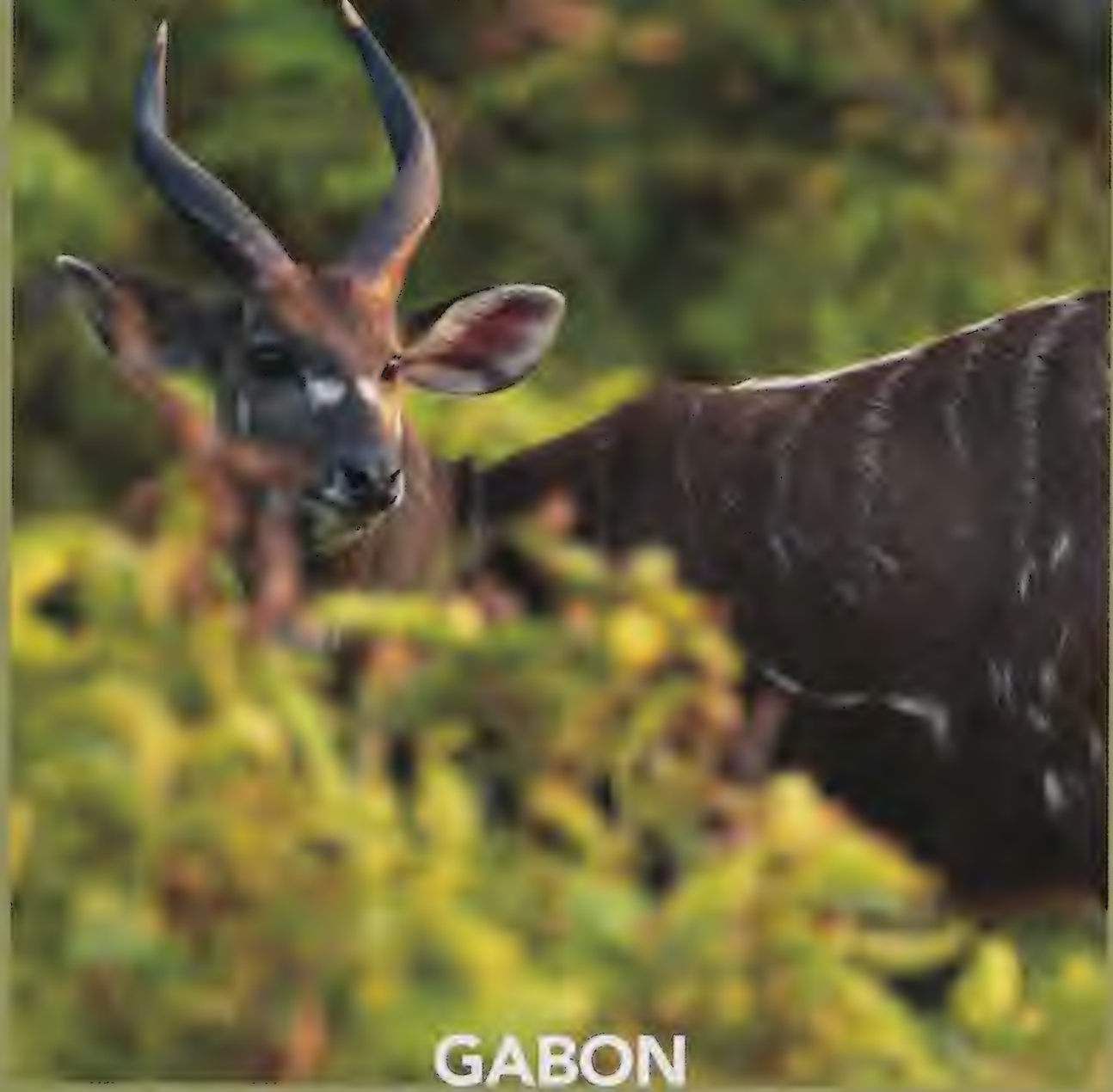
In a search throughout the swamps and lowlands of the complex, our team of herpetologists has recorded 159 different species. These include 75 elusive amphibians, 73 of which are frogs. Marius Burger, a leading South African herpetologist, points out that "one of the frogs has proved difficult to identify and may actually be a new species. It's a reddish-brown creature with a white stripe outlined in black running from the snout to the hind leg on each side. We know that it is in the genus *Hyperolius*, commonly called reed frogs, but so far we haven't seen it described in the literature."

The reptilian findings were equally impressive, among them 22 species of lizards and 46 species of snakes. The snakes include the spectacularly patterned rhinoceros viper (*Bitis nasicornis*), which sports a signature upturned "horn" at the end of its snout that gives it its name, and the beautifully colored arboreal green bush viper (*Atheris squamiger*), a patient predator that hangs upside down from branches at night and ambushes small rodents, lizards, and frogs.

The herpetologists also recorded three amphisbaenians (burrowing, snakelike reptiles) of a type previously known only from a single specimen described 96 years ago! And their finding of a large and healthy population of the slender-snout crocodile (*Crocodylus cataphractus*) is very important because this species has become severely imperiled through over-hunting and

SHELL DRILLING PLATFORM IN GAMBA. SHELL USES SMALLER OILRIGS THAT CAN FIT DOWN SMALLER ROADS, REDUCING THEIR ROAD-CONSTRUCTION COSTS, AS WELL AS REDUCING ROAD-BUILDING IMPACTS.

A CHAMELEON (*CHAMAELEO DILEPIS*) FROM A RABI SURVEY.



Tragelaphus eurycerus, a rarely sighted bongo.

GABON

SUSAN LUMPKIN

We don't hear much about Gabon in the news—which is a good thing given that mayhem is far more attractive to the media than its absence. A Colorado-sized nation straddling the Equator on the coast of west central Africa, Gabon enjoys a stable democratic government and is among Africa's wealthier countries thanks to abundant natural resources.

Its population is also small—about 1.2 million—with an average density of only four people per square kilometer. (For comparison, Colorado's population density is about 12 people per square kilometer, while that of New Jersey, the most densely populated state in the U.S., is 402 people per square kilometer.) What's more, about half of the people live in Gabon's three largest cities, while the rest of the country is populated sparsely or not at all. Less than one percent of the land area is devoted to agriculture; the presence of tsetse flies, which transmit a parasite that causes sleeping sickness in livestock and people, has precluded the development of a cattle industry.

Timber exports were once Gabon's primary source of income, but since the 1970s, revenues from oil, and, to a lesser extent, mining—Gabon boasts some the world's richest manganese and iron deposits—superseded those of timber. For all of these reasons, Gabon's biodiversity remains mostly intact. And although most of it's lush forests have been or are being selectively logged, 60 to 80 percent of the country remains covered in rainforest, estimated to contain more than 3,000 plant species, more than 20 percent of which are endemic—species found nowhere else. Other rich habitats include savanna and coastal plains.

Gabon is home to about 190 species of mammals, 600 species of birds, 70 species of reptiles, and 100 species of amphibians. Gabon forms about 13 percent of one of Conservation International's most important wilderness areas, called the Congo Forests of Central Africa. After Amazonia, the Congo Forests are the second largest block of tropical rainforest on Earth.

Despite Gabon's advantages, maintaining its biodiversity will be a challenge. Declining oil revenues in recent years have renewed the government's interest in exploiting its timber resources. There is recognition, however, that forests must be carefully managed for sustainability and that some forests must be protected. To this end, Gabon created 13 new national parks in 2002, thus protecting more than ten percent of the country's surface area. The government is also encouraging the development of an eco-tourism industry as a source of revenue. The abundance of such high-profile species as forest elephants, gorillas, chimpanzees, and other primates, as well as the country's stability, makes this a viable option.

At the same time, however, the bush-meat market threatens these and many other species. Roads built for the forestry industry make more and more of the forest species accessible to hunters, and make it easier to transport the meat to urban markets. Outbreaks of the deadly Ebola fever in the Gabon/Congo border area have also killed many gorillas and chimpanzees. Bush-meat hunters and other people who come into contact with infected gorillas or chimps come down with the disease as well. Gabon is trying to educate people about these dangers, in hope of protecting both its people and its other primates. It is also working to control illegal hunting.

Little is known of Gabon's history before the Portuguese landed on its shores in 1472. In the ensuing years, French, Dutch, and British merchant ships plied the coast, purchasing slaves, ivory, and timber. The slave trade ended in the mid-19th century and Gabon's capital, Libreville, was established as a haven for freed slaves. France claimed the country as a colony in 1910; 50 years later, it gained its independence. French remains the official language.

KINGFISHER (*ALCEDO QUADRIBRACHYS*).

destruction of its habitat. The team produced rare footage when they videotaped the hatching of a crocodile egg found in a wetland nest as it emerged from the shell.

Combinations of traps that use 100-meter-long (328-foot) drift fences capture animals alive and unharmed. These passive capture devices—the animals basically follow along the fences until they fall into the traps, which are set in the ground—are very effective in sampling nocturnal species and secretive species that live in leaf litter.

Many biologists prefer to work quietly in the forest, but our team of herpetologists also takes great joy in bringing the forest to the public. They traveled 85 kilometers (52 miles) south from Rabi to Gamba, a town of about 8,000 people in the complex, to make four presentations on snakes: one for the general public, one for Shell security guards, and two for schoolchildren. The team carefully exhibited several live specimens so that people could see creatures they ordinarily would not encounter in the forest. "The school kids were surprisingly eager to pet the snakes," Burger states, "but the adults showed a lot more reluctance."

BIRDS IN THE MIST (NETS)

In all, we have recorded 316 different species of birds. The total number of species known from those sites is 455, based on a survey conducted in 1992. We hope to catch sight of the rest of the species in future work. "We are particularly excited about species such as the African gray parrot (*Psittacus erithacus*) that we encountered," says the Smithsonian's George Angehr, who heads up the bird team. "That bird, like many other tropical birds, has experienced declines because of the pet trade."

This team uses lightweight mist nets to catch and release birds. The nets are strung between trees at various heights throughout different forest habitats. Vocalizations and opportunistic methods such as sightings are also used to record birds. The bird team members are often the earliest risers at the camps, walking out to open their nets and sit quietly as they listen for morning calls. The team found that 73 percent of the bird communities at the Rabi and Toucan sites are dominated by species that prefer interior forest habitats. Other birds seem to prefer regenerating forest or even sites that have been disturbed by logging. The highest capture rate was at Mbari near Rabi, a logged-over site where large

GRASSLANDS FROM THE VERA PLAINS NEAR THE SOUTHERN EXTENSION OF THE NDOGO LAGOON AND THE TROPICAL RAINFOREST OF THE DOUDOU RANGE. THE MOST RECENT SAMPLING SITE WAS IN THESE MOUNTAINS, IN THE NEWLY CREATED MOUKALABA-DOUDOU NATIONAL PARK.

A BIRD'S EYE VIEW OF RAINFOREST CANOPY IN ONE OF THE LARGEST CONTINUOUS RAINFORESTS IN CENTRAL AFRICA.

numbers of yellow-whiskered greenbuls (*Andropadus latirostris*), greenish-brown birds with yellow beards, were attracted by an abundant berry crop on bushes that proliferate in the area.

One important question the bird team is addressing in its research is how birds react to disturbances, such as infrastructure for oil extraction. So far, we've seen varied responses. Some birds such as the brown illadopsis (*Illadopsis fulvescens*), which inhabits interior forest and whose habitat has been interrupted by a road, were flying back and forth defending territory on both sides. Other species in the same area were apparently nonplussed. We have seen flocks of great egrets (*Egretta alba*) flying around gas flares despite the heat, noise, and light. And the crowned eagle (*Stephanoaetus coronatus*), the largest eagle in Gabon and a species protected by Gabonese law, was a special sighting next to a new road.

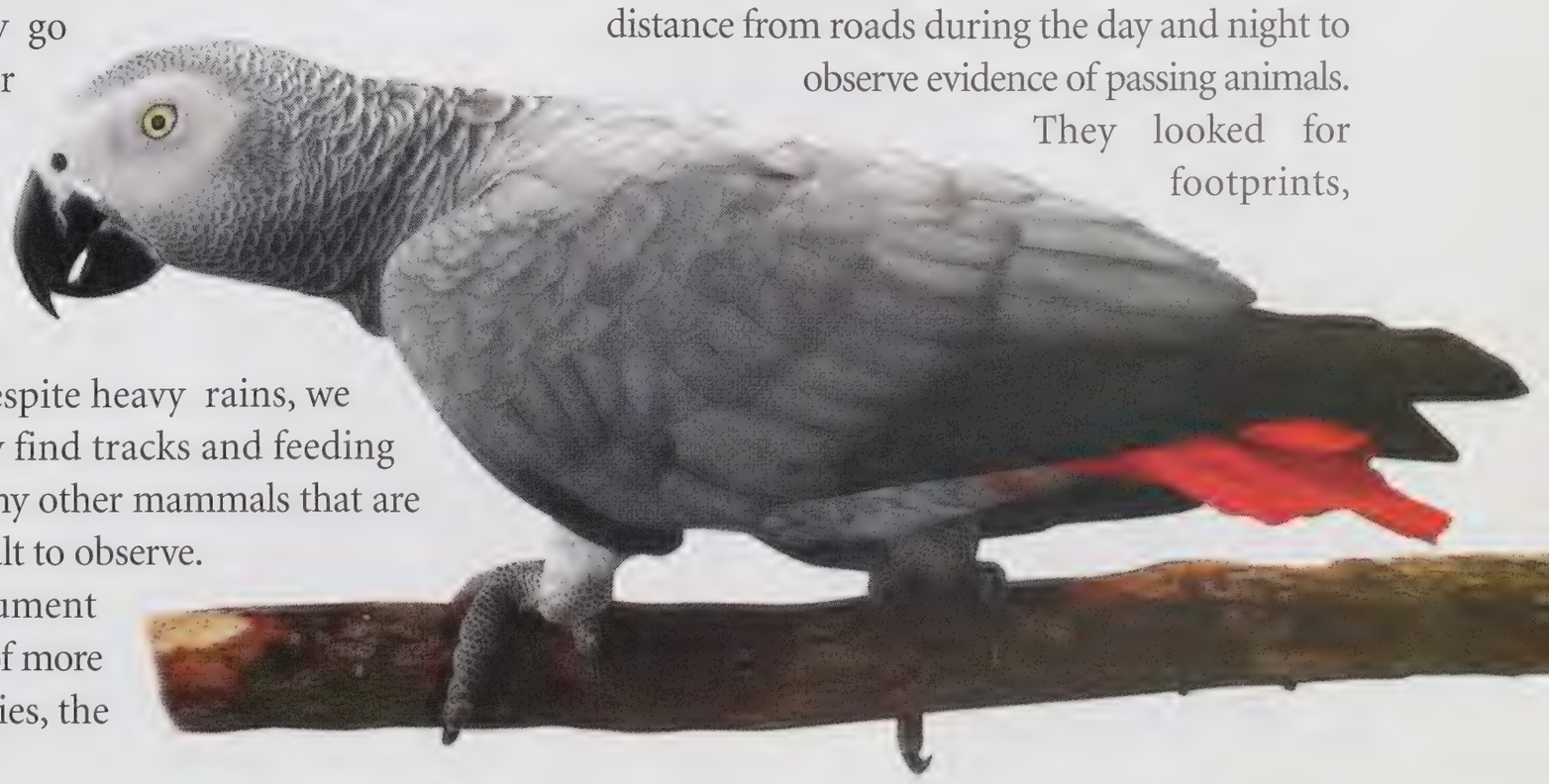
"Bird activity is not strongly affected by roads and flares at this point," Angehr notes, "and that is good news—for now. It will be important to monitor the area of the new road and determine if it creates access for logging and hunting."

MAGNIFICENT MAMMALS

Our mammal team has recorded 42 medium and large mammal species throughout the Gamba Complex. Among the most frequently documented species are well-known animals such as African elephants (*Loxodonta africana*), lowland gorillas (*Gorilla gorilla*), chimpanzees (*Pan troglodytes*), and African forest buffalos (*Syncerus caffer nanus*). Less familiar species include sitatungas (*Tragelaphus spekei*), large antelopes that live only in muddy, swampy habitats; putty-nosed (or white-nosed) guenons (*Cercopithecus nictitans*), arboreal monkeys that live in groups; and cat-like African civets (*Civettictis civetta*), and servaline genets (*Genetta servalina*). It is not uncommon for us to encounter elephants every day as they go about their business; in fact, we see five to ten or more on a typical evening. Despite heavy rains, we consistently find tracks and feeding signs of many other mammals that are more difficult to observe.

To document the activity of more elusive species, the mammal team used trip-wire cameras baited with different types of lures, primarily scents, to attract animals for photographing. These olfactory lures are made from the scent glands of carnivores such as skunks, bobcats, and coyotes, which mark their territories with their scents. When an animal in the complex approaches a lure, the camera takes its picture. With this technique we've taken pictures of elephants, red-capped mangabey monkeys (*Cercocebus torquatus*), a leopard (*Panthera pardus*), and two species of forest antelope called duikers.

The mammal team also walked transects at a distance from roads during the day and night to observe evidence of passing animals. They looked for footprints,



AN AFRICAN GRAY PARROT.

GABON CENTER FOR CONSERVATION OF BIODIVERSITY

One of the outstanding accomplishments of the Gamba Complex Biodiversity Project was the creation of the Gabon Center for Conservation of Biodiversity in Gamba, on its way to becoming a first-class research, training, and specimen-processing facility. Carved out of a former disco dance club, the center became a reality thanks to the hard work and dedication of many people. It is now the home of the arthropod research team, which spends most of its hours there looking at arthropods, a group that includes insects, spiders, crustaceans, and their relatives.

This team studies all aspects of the arthropod community, focusing on the insects. Sampling insects with the appropriate instruments is a relatively easy task. But processing the massive number of insect samples that resulted from the 128 traps set in the Gamba Complex proved daunting. We gathered a team of experts and selected young people from the local work force who showed prospect and enthusiasm for becoming parataxonomists—assistants with no previous experience in identifying insects but who acquire such skills through intensive tutoring and full immersion into the world of insects.

A PARATAXONOMIST SORTS INSECT SPECIMENS IN THE NEWLY CREATED GABON BIODIVERSITY CENTER.

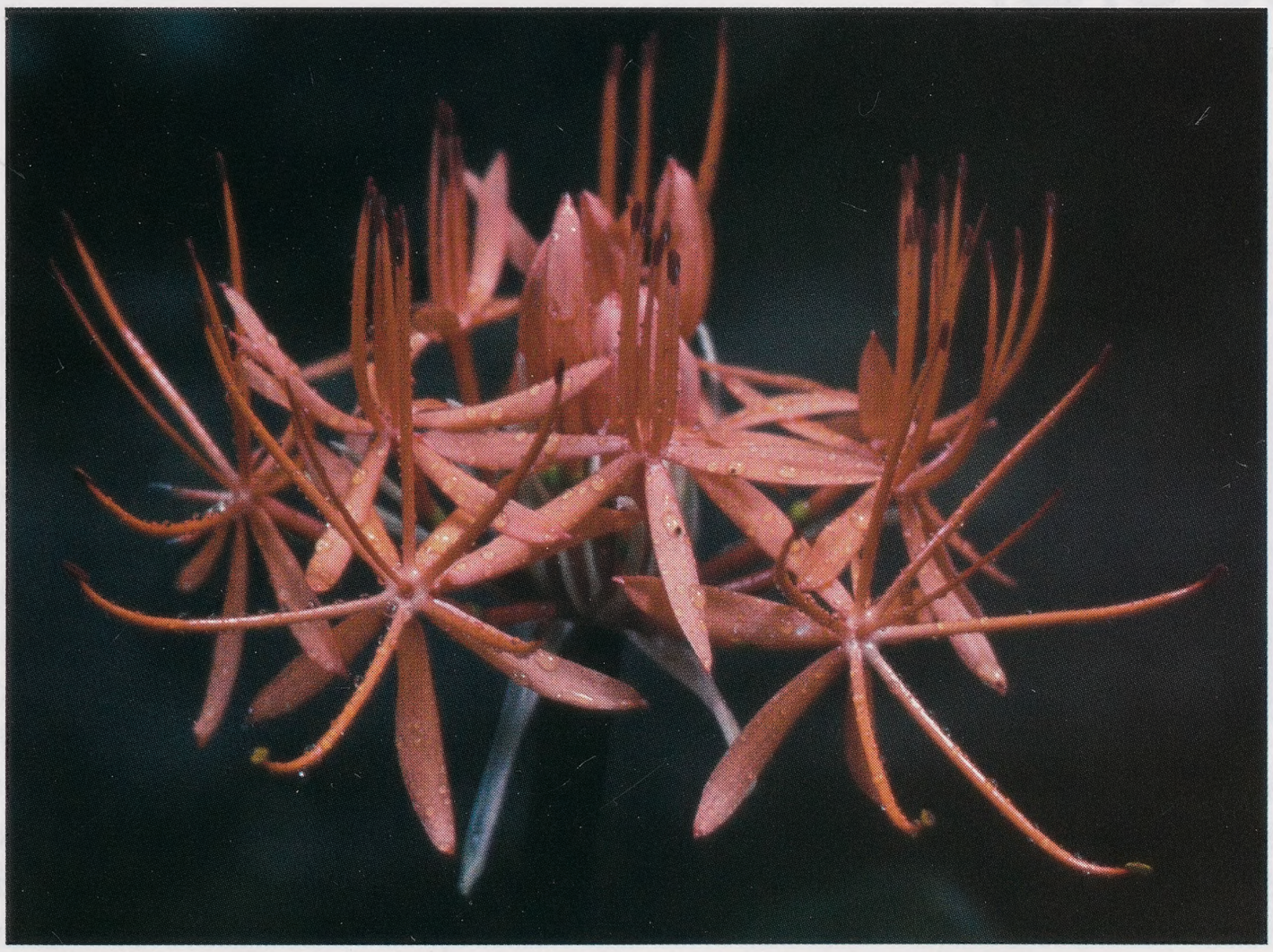
The traps were so effective that the team operated them only on weekends from Friday to Monday. Even at that, every Monday at least 12,000 insects had to be processed, 600 of which were prepared and stored in entomological cabinets. These activities generated a wealth of data, which were entered in a computer database for use in future analysis.

At the end of the year-long arthropod assessment, the team had examined more than 440,000 insects, filled more than 100 entomological drawers at the center with 20,000 professionally prepared specimens, and accumulated representatives of nearly 200 different taxonomic families in the lab's reference collections. We also selected 26 groups of insects for more intense study. The total number of species in those groups exceeded 1,000.

©YVONNE MALCH / SIMAB

MALAISE TRAPS CAPTURE FLYING INSECTS—PART OF A YEAR-LONG INSECT STUDY IN GAMBA.

A RAINFOREST TOAD (*BUFO TUBEROSUS*).



RAINFOREST FLOWER.

nests, scat, and, of course, for the animals themselves. Occasionally, they saw animals such as galagos—small, primarily nocturnal primates referred to as "bush babies," which, while not rare, are seldom seen.

Raphaël Ngangui, a Gabonese field technician who works with the small and large mammal teams, noted that, during the dry season, "We revisited some of the same sites in the dry season that we had surveyed in March in the rainy season. We found evidence of some of the same major species, but not others. Obviously, climate differences have an effect on animal behavior and movement. Monkeys, for example, will move to find trees with fruit that matures in different seasons."

MAB BOTANIST HOLDS A VEGETATION SAMPLE, NEAR RABI.

THE HERPETOLOGISTS ALSO RECORDED THREE AMPHISBAENIANS (BURROWING, SNAKELIKE REPTILES) OF A TYPE PREVIOUSLY KNOWN ONLY FROM A SINGLE SPECIMEN DESCRIBED 96 YEARS AGO!

NEXT STEPS

This project has certainly captured the hearts of those of us who are involved in the fieldwork, despite the fact that it takes us away from our families and homes for weeks at a time. We are in the midst of new discoveries that may prove beneficial to people as well as to imperiled species and habitats.

In the process, we are training more than a dozen Gabonese scientists and parataxonomists in well-tested, standardized, biodiversity research and data-management protocols. Open houses, lectures, and slide presentations in surrounding communities, and regular reports from the field will continue to inform scientists, governmental officials, Shell employees, local residents, and the public at large of our progress and results. For example, the Gabon Biodiversity Center, established in the fall of 2001, is proving to be a world-class facility to coordinate research and its applications for conservation, to process samples, and for training. (See sidebar, "Gabon Center for Conservation of Biodiversity" page 28.)

Over the next few years, our work in the Gamba Complex will continue to document the amazing biological diversity of this part of the world. We are particularly pleased that the Gabonese government has established a new national park system that encompasses nearly 11 percent of the country's lands and waters. And in September 2002, the Smithsonian joined a U.S. delegation headed by Secretary of State Colin Powell that traveled to Gabon to formalize the Congo Basin Forest Partnership for biodiversity conservation and sustainable development.

This development infused new energy into our combined research, training, and communications effort. The Smithsonian/Shell partnership continues to produce high-quality biodiversity data and analyses that are generating necessary dialogues between industry, conservation organizations, governments, and local communities. We look forward to contributing more information and knowledge as a promising future for biodiversity in Gabon emerges.

—Francisco Dallmeier, Alfonso Alonso, Patrick Campbell, and Michelle Lee are with the Smithsonian Institution's Monitoring and Assessment of Biodiversity (MAB) Program, a program of the National Zoo's Department of Conservation Biology. MAB focuses on the broad goals of research and education and seeks to integrate science—especially conservation biology—with resource development projects around the world. In cooperation with governments, industry, and other research entities such as zoos, the program strives to conserve Earth's storehouse of biodiversity and the potential that millions of species hold for future generations. The Gabon Biodiversity Project described on these pages is a collaboration of our program, Shell Gabon, Shell Foundation's Sustainable Energy Program, the Gabonese government, and other national and international organizations. Late this fall, a book entitled The Edge of Africa *will be available from Hylas Publishing, featuring the photographs of Carlton Ward, Jr., and text by the authors featured here.*

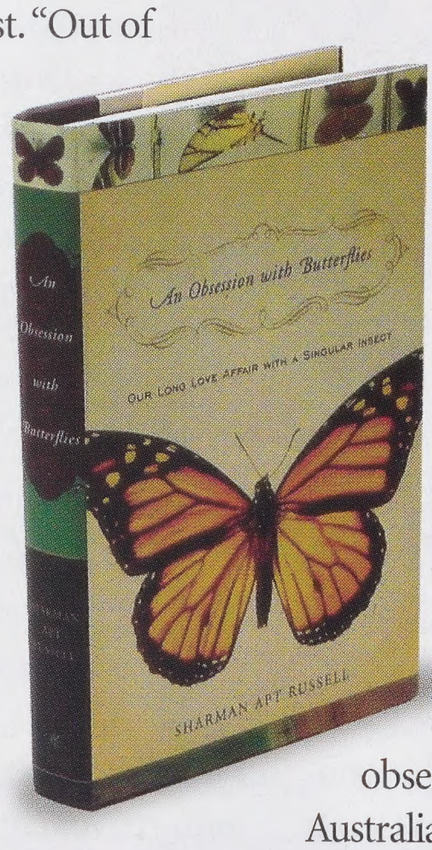
BOOKS, NATURALLY

***An Obsession with Butterflies: Our Long Love Affair with a Singular Insect.* Sharman Apt Russell. 2003. Perseus Publishing, Cambridge, Massachusetts. 238 pp., hardbound. $24.**

***A Few Short Notes on Tropical Butterflies.* John Murray. 2003. HarperCollins Publishers Inc., New York. 274 pp., hardbound. $24.95.**

Many years ago, I invited National Zoo scientists to share a personal experience of the rainforest with *ZooGoer* readers. The vignette contributed by David Challinor, now a Smithsonian Senior Scientist Emeritus, was my favorite. David recalled that the nuns who taught him as a small boy likened his soul to a sheet of clean white paper.

This evoked in young David an image of his soul as a small, very thin, very white card that floated lightly above his head. Forty years later, David saw for the first time a white Morpho butterfly in the Honduran rainforest. "Out of the corner of my eye," he wrote, "I saw a pure white shape, about 3″ x 5″, come out of the forest and drift across the opening....It barely flapped its wings, and as I breathlessly watched it my mind flashed back to the nuns' description of my soul.... Never again have I encountered an experience comparable to watching my soul glide silently across a tropical forest glade."



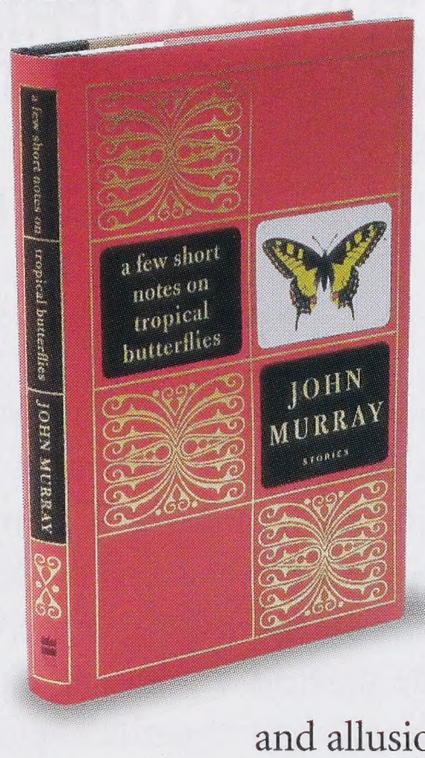
In *An Obsession with Butterflies*, Sharman Apt Russell writes, "The butterfly is a human soul. What could be more obvious?" The Greeks used the word psyche for both, and a law in 17th-century Ireland banned the killing of white butterflies because they were children's souls.

In this lovely little book, itself only a bit larger than a Morpho butterfly, Russell explores the world of butterflies through the eyes of people obsessed with these winged insects. With the zeal of missionaries out to save human souls, naturalists and scientists have gone to the ends of the Earth to collect and study butterflies, and while butterflies can be admired simply for their beauty, understanding their biology makes them still more fascinating.

Russell is not a science writer in the conventional sense. Instead, she paints lyrical pictures to reveal what is known about butterflies. How they develop through a series of transformations from eggs to adults is sketched with scientific accuracy and summarized in poetry: "A bag of goo crawls on a leaf, obsessed with eating. It hangs upside down. It becomes something else. A butterfly is born, a bit of blue heaven, a jazzy design."

Russell does the same to explain the diversity of colors butterflies come in a chapter called "Butterfly Matisse." Mating, mothering, migrating, mimicry, and moths are the themes of other chapters. Of the occasional mass migrations of Snout butterflies in the southwest U.S. she writes, "...millions of Snouts filled the sky....They clogged car radiators. They ruined laundry. They passed overhead like a muddy, aerial river."

Of the people obsessed with butterflies, Russell writes about Henry Bates, an heroic 19th-century collector of butterflies in the Amazon, about writer and lepidopterist Vladimir Nabokov, and others, including a British scientist whose life's work is the 18-volume *Moths of Borneo*, and a former L.A. gang member saved from a life of crime when he discovered El Segundo Blue butterflies. From each of these men and women, Russell has captured delightful admissions of their obsession. Here she quotes an Australian biologist: "'There was a time in my life," Bert confesses, "when butterflies supplied for me all that I might otherwise have sought in art, literature, religion, and romantic love.'"



The men and women John Murray brings to life in the eight exquisitely written stories that comprise *A Few Short Notes on Tropical Butterflies* are obsessed too. Obsessed with butterflies, beetles, cholera bacteria, hardware. Like that of Russell's Australian biologist, the obsessions of some are substitutes for a fuller life; others lose their lives to them. These characters are mostly scientists, physicians, collectors, and explorers, and their behavior exposes the utter selfishness of people who live only to satisfy their need to possess and order the unruly world around them.

The grandfather of the unnamed protagonist of the title story was a fictional correspondent with Henry Bates (one of many coincidental connections between these books). He pursued his obsessive desire to capture a Queen Alexandria's Birdwing, the world's largest butterfly, in New Guinea. With ruthless single-mindedness he succeeded, but he left his ailing friend behind to be killed by hostile locals, and he himself became, in the words of the protagonist's wife, "the only man I have ever known to be killed by a butterfly." He resorted to cannibalism on his adventure, and years later lost his mind and his life to *kuru*, a disease that slowly eats away the brain. But, his grandson says, "Somehow, when I look at the marvelous splashes of life and color that these butterflies still provide, I feel certain that he believed that it had all been worthwhile."

Butterflies as a metaphor for the soul, and the ephemeral nature of life, appear often in these richly textured tales. But butterflies are also symbols of redemption, of life begun anew when a butterfly struggles to free itself from its cocoon. This is the central lepidopteran metaphor of this collection. Murray's characters reach crises during which they break free of their pasts and emerge, for better or worse, transformed—and, sometimes, less egocentrically lonesome.

These two books, so different in substance and style—one fiction, one factual—form mutually illuminating companions. I read them together—a story from one, a chapter from the other. I recommend this. In my mind, fiction and fact, art and science, resonating metaphors and allusions flitted between the two, like butterflies who, fluttering between flowers, light up our life.

—Susan Lumpkin

BIO ALMANAC

GOOD NEWS

The endangered San Joaquin kit fox (*Vulpes macrotis mutica*) is getting much-needed help from an agricultural company. In May, Paramount Farming Company entered into a Safe Harbor Agreement and currently provides and maintains 25 artificial dens throughout its 1,668-acre property in Kern County, California. "The dens are good news," says Howard Clark, the biologist who is monitoring kit foxes on Paramount Farms. "The dens are strategically located in such a way as to allow kit-fox movement from one grassland area to another through a series of cotton fields and almond orchards." The artificial dens aim to decrease coyote and red-fox predation and facilitate safe travel throughout the farm fields. They are constructed from eight-inch-diameter pipe too narrow for predators to enter, but suitable for kit foxes.

The San Joaquin kit fox, one of the first animals placed on the U.S. Endangered Species List, has been significantly affected by agricultural and residential development in its native habitat. Foxes require large territories—about one square mile of territory for each animal, with fox families using as many as 30 dens over 600 acres. As more land is developed, fox populations become increasingly fragmented and vulnerable to predation and vehicle traffic. So far, Clark has found kit-fox scat near the entrance of one of the dens. He has also found evidence of other animals using the dens, including jack rabbits, cottontails, skunks, kangaroo rats, deer mice, and a variety of insects and spiders, as well as scat from burrowing owls—a species of special concern in California.

BAD NEWS

The dire economics of coffee growing are significantly impacting the ecology of Indonesia, Vietnam, and Latin American countries. The problem is unregulated prices: For every pound of coffee sold for $5 in the United States, Indonesian farmers see a profit of only 35 to 45 cents. With coffee prices at all-time lows, thanks to flat demand and increased production this last decade, millions of farmers barely sustain a livelihood. They've had to plant more coffee to increase yields by changing cultivation practices from shade- to sun-grown coffee.

This spells bad news for farmers, as well as for wildlife. In Indonesia, 28 percent of the protected land in Sumatra's Bukit Barisan Selatan National Park has been converted to coffee plantations since 1985. Development in this biologically diverse park threatens such important populations as the endangered Sumatran rhino (*Dicerorhinus sumatrensis*), Sumatran tiger (*Panthera tigris*), and Asian elephant (*Elaphas maximus*).

Traditionally, coffee farming preserves biodiversity because it's grown under a biologically rich tree canopy. Farmers now converting to sun-grown coffee to obtain higher yields do so at the expense of important animal habitat. For example, millions of migratory birds depend on the forest cover for survival. Sun-grown coffee also requires the use of more pesticides and fertilizers; and, with no cover to protect the ground from tropical storms, chemicals and soils wash into rivers.

Although international efforts to combat the crisis are lacking, consumers can make a difference by purchasing coffee with a "fair trade" or "bird friendly" trademark. Fair Trade™ certifies, among other things, that a minimum of $1.26 per pound is paid to farmers; Bird Friendly™ coffee is grown organically and does not require forest destruction. Next time you pick up a cup of java, remember that you hold more than just a cup of coffee in your hands.

—*Stephanie Hsia*

San Joaquin kit fox.

B. PETERSON / U.S. FISH & WILDLIFE SERVICE

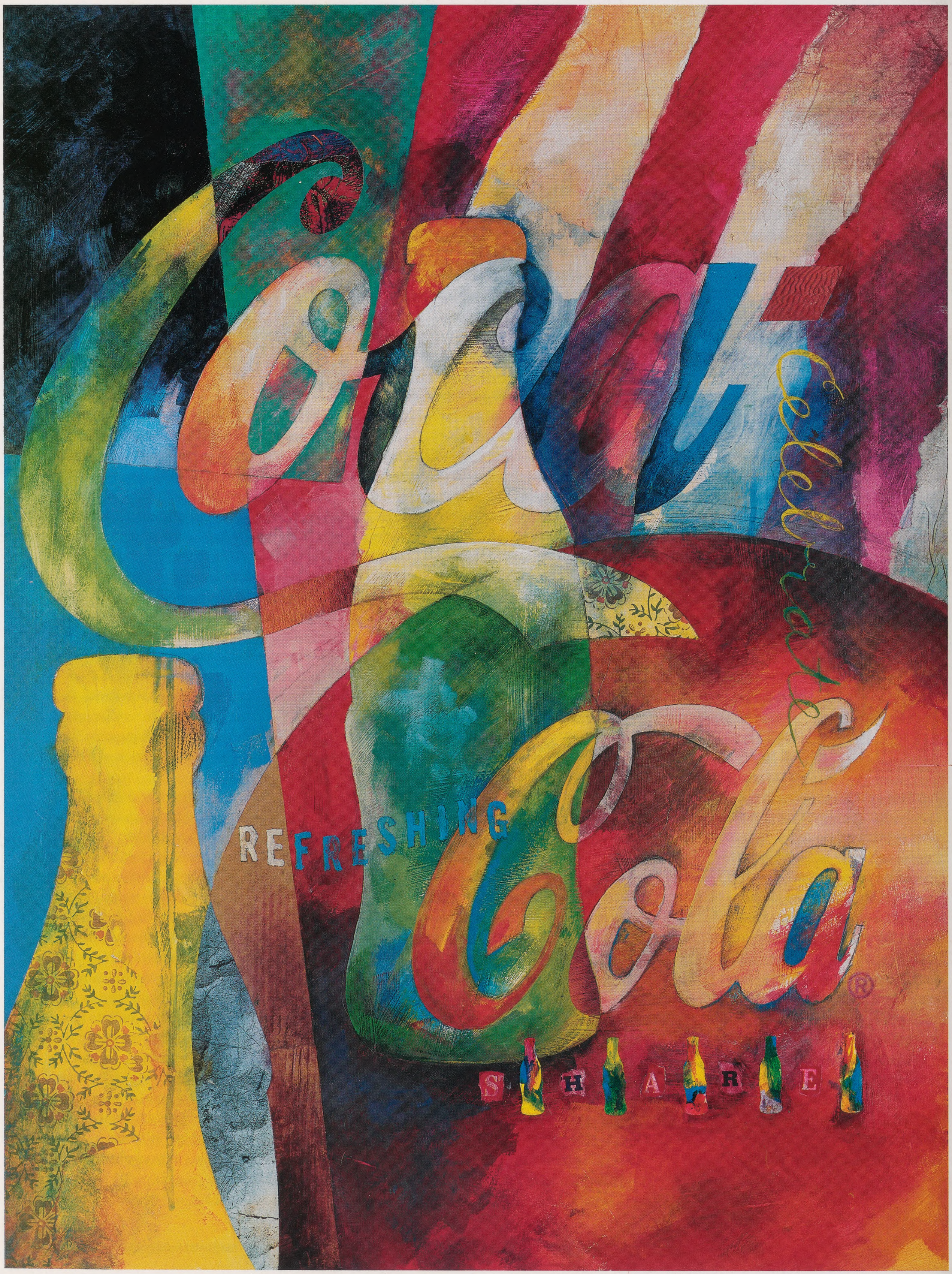
WHAT'S IN A NAME?

The scientific names of the various river dolphins have diverse origins and reflect several of the various ways that scientists form these terms. The pink, or Amazon, river dolphin's genus name, *Inia*, is based on the name given to the dolphin by local people in Bolivia, while the species name, *geoffrensis*, is a tribute to the French naturalist Etienne Geoffroy Saint-Hilaire (see p. 16).

The Yangtze River dolphin's name, by contrast, is *Lipotes vexillifer*. *Lipotes* is from the Latin, *leipo*, meaning "left behind." This may refer to its river distribution in general, or to the fact that its type locality—the origin of the specimen on which the original description was based—was 600 miles up the Yangtze River, very far inland. *Vexillifer* is from the Latin *vexill*, meaning "banner" or "flag," possibly a description of the dolphin's high dorsal fin.

The Ganges and Indus river dolphins share the genus name *Platanista*, which comes from the family name, Platanistidae. The term Platanistidae, whose meaning is lost, was used by Pliny the Elder in his *Natural History*, written in Rome in the first century. Pliny wrote: "Within Ganges, a river of India, there be fishes snouted and tailed as Dolphins, 15 cubits long, which they call Platanistæ." (Pliny assembled his facts from many diverse and often questionable sources. Clearly, reports of the dolphins' size became exaggerated in their passage from India to Rome. Fifteen cubits is about 22 feet, but in fact they measure from about six to ten feet in length.) The Ganges River dolphin's species name, *P. gangeticus*, indicates where these animals were found, while the Indus River dolphin, named about 50 years later, was dubbed *P. minor*, as it was thought these dolphins were smaller than the Ganges form.

—*Susan Lumpkin*


REFRESHING
Coke
SHARE